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THE UNIVERSITY OF ALBERTA

LOGO INTERPRETATIONS
AND IMPLEMENTATIONS

An Ethnographic Approach

by



Ruth Pauline Cypher

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES AND
RESEARCH IN PARTIAL FULFILMENT OF THE REQUIREMENTS
FOR THE DEGREE OF MASTER OF EDUCATION.

DEPARTMENT OF ELEMENTARY EDUCATION

EDMONTON, ALBERTA

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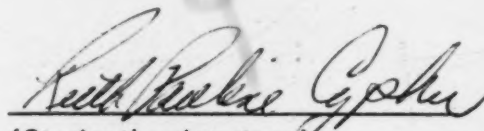
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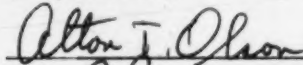
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submitted by Ruth Pauline Cypher

in partial fulfilment of the requirements for the degree of
Master of Education.


(Supervisor)





Date: 15 May 1987

DEDICATION

Dedicated to Richard Cypher, who not only encouraged me to undertake the gaining of a Master's Degree, but continually provided love and moral, emotional, and physical support through the coursework, research and writing of the thesis.

ABSTRACT

As humankind nears the 21st century, we find ourselves entering an age in which the quantity of information is increasing at such tremendous rates that man can no longer deal with it using current technological and human resources.

The educational computer language Logo, devised by Seymour Papert and Associates, was designed to allow its users to develop problem-solving strategies and thinking skills. Such resources would better equip people to deal with the demands of the Information Age. Using ethnographic methods, the ways four 'ordinary' elementary school teachers interpreted Logo and the strategies and techniques they used in implementing it with their classes were researched. Another dimension to the Logo interpretation and implementation was added by using two Special Education Classes. The data gained also allowed one to examine the environment created by the teachers to discover if these environments reflected Papert's priorities, and/or his concerns that Logo would not be implemented in ways that would allow a child-centered, child-directed learning environment. The researcher acted in the role of an assistant to the teacher and also as a participant observer.

Within the context of the Logo class, the four teachers emerged as disseminators-of-knowledge, maintainers-of-the-system, and as a catalyst for the interactions of the students.

These results imply that even though computer programs may be developed that have the potential to enhance thinking and problem solving or that allow and encourage child-directed and child-controlled learning, unless they are implemented within an environment that is supportive, as well as by persons who will support such methods of learning, then the potential of the program and the participants, as envisaged by Papert, will not be reached.

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CHAPTER ONE

INTRODUCTION

The reasoning animal has, perhaps inevitably, fashioned the reasoning machine. With all the risks apparent in such an audacious, some say reckless, embarkation onto sacred ground, we have gone ahead anyway, holding tenaciously to what the wise in every culture at every time have taught; the shadows, however dark and menacing, must not deter us from reaching the light. (Feigenbaum 1984 p. 292)

Many scientists believe that in the near future, power and wealth will not be based on natural resources and other criteria now being used, but will be based on the acquisition and distribution of knowledge. Information has, and is, increasing at a tremendous and almost inconceivable, rate. The human brain is virtually incapable of gathering, understanding, processing, or storing even a small percentage of such vast volumes of information. If this 'Information Age' is indeed about to emerge, as Dr. Fuchi, a key figure in the Japanese ICOT project to develop truly intelligent computers, suggests, what effect will this have on the common man? Will this 'Information Age' bring about a whole new social and commercial era or order as did the 'Industrial Age? (Hoban 1985)

That the information known to man is increasing exponentially is a fact, not an opinion open to argument. If, as many scientists believe, information becomes the commodity of commerce, then information will indeed be power and the computer an amplifier of that power. The computer revolution now taking place is a transition

from information processing to knowledge processing, from computers that calculate and store data to computers that reason and inform.

But again the question needs to be asked and serious consideration given to it: "Of what relevance is this to the everyday lives of the majority of the men, women and children? So a new Age is coming -- how will that affect the everyday lives that go on around us and in which we are so intimately involved?"

Pamela McCorduck, co-author of The Fifth Generation is very optimistic and holds great hope for those involved in the new 'Information Age'. She states that:

Once fifth generation technology becomes ubiquitous, intelligent computers will fade into the wood work, transparent as the microprocessor embedded in today's audio and video equipment. These machines will provide a decision and planning support system, giving people a huge amount of control over the outcome of events. Using computers to create what-if scenarios, people will be able to figure out optimal ways of conducting their own lives. (As quoted in Hoban 1985 p. 72.)

Dr. Fuchi shares this optimism as shown in his statement:

When the masses have access to intelligent machines and data bases chronicling virtually all human knowledge, they will no longer be forced to abide by whatever officials decide. The fifth generation will ultimately redistribute worldly wealth in the form of human knowledge. And that will usher in the rebirth of democracy, forging an age more expansive and human than the Greeks could have ever envisioned. (As quoted in Hoban 1985 p. 72.)

If such conditions are indeed inherent in the forthcoming 'Information Age' can one help but welcome such a coming and ask, "How can I prepare myself and others so that we may be active participants in this 'brave, new world'?"

However, there are as yet many unknowns. It is not known whether intelligent machines, even when given the same heuristics that humans use, will necessarily think the same as people. As yet we do not know whether new knowledge can be discovered by machines and if this does prove to be the case, what might the implications of such new knowledge be. Nor do we know whether such "knowledge networks, worldwide as the Japanese envisage it, will offer unprecedented opportunities for mischief on the part of government or outlaws... We do not know how to imbue humans with the critical intelligence to evaluate the knowledge they are exposed to" (Feigenbaum 1984 p. 299).

Obviously the future is uncertain but what is not uncertain is the fact that the current generation and those that follow it are going to have to deal with vast quantities of information. Schools and educational systems are the traditional distributors or passers-on of information, culture and knowledge. However, the majority of the current educational systems are indeed very traditional in the methods and strategies they employ to disseminate knowledge and are thus inadequately equipped to deal with the implication of such an information age.

Are there any methods, approaches, strategies, philosophies or paradigms that teachers can use to prepare students to not only survive but flourish in the Information Age? If traditional education systems seem woefully inadequate, what other choices are available that can be employed to equip the participants of this new age with

the skills they require to succeed and find joy in their success? If such approaches, programs, or curriculums are presently available, what are they? Is it realistically possible to implement them within our current educational system? How does one go about implementing them if they are known? Perhaps the most basic, and important question that needs to be asked is, "Are those responsible for educating the generations of children to whom the new Information Age belongs, seeking out new ways to equip these children with the necessary skills to deal with what lies ahead?"

These questions I feel are of vital importance and form the parameters, the impetus and the reason behind this research project. While more specific questions were dealt with in the actual research, these general questions form the framework and purpose behind the design and methodologies used in the research. These general questions are basic, for only those uninformed or uncaring can question the fact that we are going to have to find new ways of approaching and dealing with information. And man will indeed, if things continue on their present course, develop new and more complicated and sophisticated methods and machines in an attempt to deal with the increasing volume of knowledge that he has discovered and created. Such is the nature of man as evidenced in that "we have gone ahead anyway, holding tenaciously to what the wise in every culture, at every time have taught; the shadows, however dark and menacing, must not deter us from reaching the light." (Feigenbaum 1984 p. 292)

BACKGROUND TO THE STUDY

Seymour Papert, a mathematician who has become seriously involved in the area of artificial intelligence, feels that our current educational system "...virtually hasn't changed since the Middle Ages." (Nelson and Friedman 1981 p. 12) and therefore is not formulated nor equipped to deal with the demands of an Information Age. Based upon the ideas he formulated concerning "...children, the nature of thinking, and how children become thinkers" (Papert 1980 p. 208) while working with Jean Piaget from 1959 to 1964, Papert set out to discover, or to create, some method or instrument that would aid children in their ability to learn, think, and build their own 'intellectual structures'. Because the current educational systems are not designed to teach children how to think and learn, but rather are systems by which information is passed on, Papert felt a whole new way of approaching learning was required. Papert refers to his own philosophy as

revolutionary rather than reformist in its concept of change. But the revolution I envision is of ideas...of new understandings of specific subject domains and in new understandings of the process of learning itself...In my vision, technology has two roles. One is heuristic. The computer presence has catalyzed the emergence of ideas. The other is instrumental. The computer will carry ideas into a world larger than the research centers where they have incubated up to now. (Papert 1980 p. 186)

Because each person is unique, they have their own learning and thinking styles. The view that what children learn in schools today will provide them with necessary skills to enjoy success in jobs for their entire lives, Papert considers a myth. "The world is

changing too rapidly. What educators must enable children to develop, are thinking and coping strategies that will allow them to operate amidst change." (Coon 1982 p. 14) One approach to attaining this goal is allowing the learner to take charge of his learning, by supporting children "as they build their own intellectual structures with materials drawn from the surrounding culture." (Papert 1980 p. 32)

For Papert, because all learning is culturally based, it must come naturally and meaningfully to the learner. "Papert calls this kind of learning 'Piagetian' learning -- learning that happens spontaneously when people are in contact with the right materials." (Turkle 1984 p. 97) Dewey, Montessori, Piaget and Papert all share the belief that children learn by doing and by thinking about what they are doing. Therefore a child's intellectual growth must be rooted in his experiences. (Papert Logo Memo No. 2 1971, p. 4-1, 5-1) It would follow then, that what is needed to help children to greater intellectual growth is providing "Children better ways and means to think about what they do; and this includes looking for activities whose structure might allow the child a particularly clear view of his own intellectual activity and so help him achieve a more articulate understanding of 'doing'." (Papert Logo Memo No. 1 1971 p. 4)

Based upon these beliefs as to the nature of learning and thinking, Papert set out to discover or devise a method that would provide such learning experiences. For him the computer became the

needed vehicle for such experiences because it gave access to objects and provided a means for their manipulation that would not be possible in any other way. What emerged from his, and other like-minded scientists' endeavors was a computer language that they called LOGO. LOGO means 'word' in Greek. According to Papert, the name was chosen for the new language "to suggest the fact that it is primarily symbolic and only secondarily quantitative" (Papert 1980 p. 210). According to its developers LOGO is a language for learning how to think. It is often referred to as a language for elementary school children, yet its design allows for the exploration of anyone's potential -- it is a language with no threshold and no ceiling. "Logo is most essentially an education philosophy. One of the ultimate aims of that philosophy is the development of both a physical environment and a set of ideas which when used properly will allow the creation of truly independent intellectual agents." (Austin Logo Memo No. 23 1976 p. 4)

Logo then, has the potential of providing children with experiences that will indeed aid in the development of his/her ability to think and learn. Since traditional 'passing-on' techniques seem inadequate in coping with the rapid world changes and increase in information, Logo presents itself as a viable alternative, or at least, an addition to present educational systems. The ability to think and reason would seem to be vital to the person coping with a world where the mere act of storing and retrieval of information is no longer the primary concern. The creators of Logo feel that

In teaching the machine how to think, the child is developing and sharpening his or her own reasoning process -- logically, systematically, and in a manner that encourages self-reliance and persistence. Logo procedures encourage students to plan their work, develop a logical sequence, and then test it. Abstract thinking is encouraged since children have to consider new possibilities and learn what to anticipate from a given procedure. (Marikuson 1983 p. 74)

If Logo allows this nurturing learning environment to be created and encourages the development of learning and reasoning skills in the users of the language, as the creators of Logo claim it does, the next questions that need to be asked and answers searched for are: "Are teachers and students aware of Logo and its potential?" "Are schools and teachers using or attempting to use Logo?" "How, and using what methods, techniques and strategies, is Logo being used with children?" "Given Logo, how do teachers interpret it and implement it with their classes?"

Because of an interest in, and concern about, such questions, this research project came into being. Another aspect that heightened the interest of doing research in Logo implementation is the expressed opinion by many, including the originators of Logo, that Logo will not be used in today's classrooms in such a manner as to reach its potential. Logo was designed to be an object to think with, a carrier of 'powerful ideas', a tool by which children could control the computer instead of the other way round. Even though Papert felt Logo could be a very powerful tool in helping people develop their own intellectual structures, he also had serious doubts as to its acceptance and application in present educational systems. Papert states, "I think there's a possibility it [Logo] won't be taken

up by schools." (As quoted by Kelman 1983 p. 7), Dr. William Higginson, a participant in Logo research at Queen's University, supports this by saying:

We are not optimistic about the chances of an authentic version of Logo reaching the average classroom. A greater barrier to the implementation of an authentic version of Logo in schools is the nature of the underlying philosophy of the language. Logo is child centered and at least on the surface, unstructured and non hierarchical. Most teachers at the present feel pressured to have formal, hierarchical and content-centered curricula. (Higginson 1982 p. 329)

Kelman (1983 p. 7) concludes his editorial with what may be the Logo-as-lived.

Already, Logo curriculum guides come replete with behavioral objectives, Logo workbooks, and Logo multiple-choice tests. Nothing could be more antithetical to the philosophy underlying Logo's development...the threat of Logo standardization... presents to educators a challenge of significant proportions, if the hopes and dreams of Logo's founders are to be realized.

To look at what is happening in classrooms as it pertains to the interpretations and implementation of Logo is the aim and interest of this research.

PURPOSE OF STUDY

It is the purpose of this study to investigate the Logo subculture as it evolves within the larger culture of an elementary school. Of specific interest are the ways in which the teachers interpret and implement Logo. The broad and overriding Research Question then is:

What Logo interpretations are made by teachers and how are these implemented?

Of more specific interest, and inherent in the general question are:

Aspect (A) What underlying pedagogical stances are inherent in the nature of the classroom context teachers construct for Logo?

Aspect (B) Do these pedagogical stances and classroom environments reflect any of the priorities expressed by Papert (1980)?

Aspect (C) Does a special education context affect the Logo implementation in any way?

CHAPTER TWO

DESIGN OF STUDY

METHODOLOGY

Since the underlying and determining research question to be explored is 'what Logo interpretations are made by teachers and how are these implemented' it was felt that an ethnographic approach would best accomplish this aim.

Werner states that

Ethnography is an interpretive methodology used to uncover and describe interpretations that participants have of a situation, as well as the interpretive procedures. (Werner 1980 p. 96)

In order that we can adequately understand what Logo means to the teachers involved in this study, a thorough description of what actually occurred in their classes, from their perspective was needed. That is, a deeper exploration into classroom experience was necessary. Ethnographic methods were a vehicle to achieve that end.

The ethnographic method of research has its historical roots within the discipline of anthropology. It is not a new methodology, but only recently has serious consideration been given to the use of ethnographic methods in the approach to studying education.

(Wilcox 1980, Wolcott 1975, Wilson 1977, Spradley 1975, Montemurro 1984, Werner 1980, Leither 1980)

Numerous definitions of ethnography have been put forth but one theme basic to all accounts is that ethnography is a descriptive endeavor. (Wilcox 1980) By using an ethnographic approach, the researcher describes the culture of a people or situation, not from the researcher's perspective, but rather attempts to record the meaning the actors themselves assign to the social events of which they are a part.

To describe a culture then, is not to recount the events of a society but to specify what one must know to make those events maximally probable. The problem is not to state what someone did but to specify the conditions under which it is culturally appropriate to anticipate what he, or persons occupying his role, will render an equivalent performance.... Test of descriptive adequacy must always refer to informants interpretation of events, not simply to the occurrence of events. (Frake 1964, p. 112)

Using ethnographic methodology is what Geertz (1973) refers to as 'thick description' in which, what is to be described, is perceived as including both meaning and behaviors (Gearing 1973, Spinder 1974, Wilcox 1980). In order to record both meaning and behavior the ethnographer must look at people and events in the context of their natural settings and in a total milieu rather than only bits and pieces. This natural setting or context must be explored as it is viewed and constructed by the participants (Wilcox 1980, Wolcott 1975). The researcher looks at, and describes not only the setting and its context but the relationships between the two. Within the context of a school, ethnographic methods are primarily used to

describe situations and the relationships of such situations to the school as a whole, the community, and the community of the teachers (Werner 1980, Wilcox 1980).

The ethnographic method is employed in an attempt to discover the knowledge a group of people are using to organize their behavior. What one is looking for is the social, cultural or normative patterns of a group of people (Werner 1980).

School activities take place against a background of premises, interests and values concerning what it means to be a student or a teacher, or what constitutes worthwhile knowledge and learning. These features are implicit in the choices made and the justifications given by school participants. In other words, classroom tasks are accomplished with prior presuppositions, beliefs, and anticipations (Werner 1980 p. 5).

Because of the complexity of the school situation a thick description is vital to understanding what is going on, because a thinner description would strip the situation of its multi-layered social meanings (Wilcox 1980, Wolcott 1975).

The ethnographer is searching for the meaning of a situation as perceived by the participants, therefore it is vitally necessary that the research is undertaken without specifically predetermined categories or observation, questionnaires, or precise hypothesis.

Because of attempting to understand a system in its own terms, according to its own criteria of meaningfulness, one cannot predict in advance which aspects of the system will have significance. (Wilcox 1980 p. 4)

Due to the fact, that by working within this methodology, one is trying to understand a system, in its own terms, ethnographic

accounts do not point out the correct way to policy decisions, do not give clues as to what should be done differently, nor do they suggest how best to proceed. An ethnographic study is descriptive in nature, not prescriptive.

This study investigated, through the use of ethnographic methods, the Logo subculture as situated within the larger culture of an elementary school. Of specific interest were the ways in which the teachers involved interpreted and implemented Logo.

An ethnography of implementation is not directed towards measuring or defining discrepancies, but to describing routine activities used by participants when implementing newly developed programs. Of interest are the ways in which teachers and administrators interpret, legitimate, and initiate a program which they perceive as needing to be implemented. (Werner 1980 p. 12)

Being ethnographic in nature, the study had to closely consider not only the teachers' actions and reactions within the cultural setting of the Logo implementation, but also the multitude of contextual aspects because,

As teachers come to a curriculum for the first time, their interpretation will depend upon the program itself and in part upon their own outlook on the subject area, their intents and motives and their immediate situations, such as particular classes to teach. (Werner 1980 p. 106)

Another aspect to be considered in a 'thick description of the teachers' implementation is that the understanding a teacher grasps is derived from the ongoing combination of his own situation and the authors intent inherent in the program.

Spradley states that "perhaps the most striking feature of human beings is their diversity." (Spradley 1980 p. 13) Werner mentions that "...school programs are the products of someone's activities, and therefore need to be understood in terms of the intents and definitions inherent within them." (Werner 1980 p. 102) The ethnographic approach was used in order to capture the teachers' diversity when using Logo with their students in a school setting.

THEORETICAL FRAMEWORK

Ethnographic methodology was used in this study because of the desire of the researcher to discover what actually occurred in the everyday school lives of the teachers and their classes as they encountered, interpreted and implemented Logo. In order that this evolving description of the Logo culture be a 'thick' one, more needed to be taken into consideration than a superficial description of the events that occurred. Things or events become meaningful to us through what we already know of the world. Each individual defines for himself the reality he encounters. This reality is a personal one, the shape of which depends on the unique elements of each person's biography. Teachers are constantly defining and redefining the reality encountered in accordance with their own system of relevances -- those elements, among all others contained in such a situation which are relevant for the purposes at hand. (Schutz

1962) While each individual's reality is a personal one, in one aspect it is also a shared one because

We live among men, bound to them through common influence and work, understanding others and being understood by them. It is a world of culture because, from the outset, the world of everyday life is a universe of significance to us, that is, a texture of meaning which we have to interpret in order to find our bearing within it and come to terms with it. (Schutz 1962 p. 11)

Therefore, the actions taken by the teachers in this study will be influenced by, and dependent upon, not only the social setting of the school and classroom but also by each teacher's personal biography. One's personal biography consists of all events, things and people experienced by that person, as well as what Schutz refers to as their stock of knowledge at hand, their natural attitude of everyday life and their practices of common sense reasoning. [Schutz as referred to in (Leiter, 1980)] One's stock of knowledge at hand includes the recipes, rules of thumb, social types, maxims and definitions one uses in going about doing things in a social situation. The second aspect referred to by Schutz, a natural attitude of everyday life, is that taken-for-granted assumption that the social world has a past, a present and a future -- that the description of the structure of the social world is an intersubjective one -- it is shared by those encountering and experiencing that social world. The practices of common-sense reasoning allow the members of a social world to create and sustain the factual character of that social world.

SELECTION OF PARTICIPANTS

It was felt that a strong desire to implement Logo on the part of the participants of this study was necessary. Several schools were contacted where there was initial high interest by administration in having the research done in their school. However, for reasons such as lack of sufficient hardware, lack of time in teachers' timetables, and lack of a written curriculum for the teachers, these schools did not participate in the study.

Within the selected school setting, four teachers were selected to participate. Selection was done, not by the researcher, but by the teachers themselves. The fact that the teachers involved in the study saw Logo as something they desired to implement in their classrooms with their students, was the determining factor in selecting the participants. Therefore, the four teachers who did take part in this research project were the ones who expressly wished to be involved with Logo.

The four teachers and their classes with whom the researcher worked during this study were:

1. Raylene and her grade two class. Raylene taught a class of 23 grade two students; the composition of the class being about evenly divided between boys and girls whose general ability level, as described by the teacher, ranged from high to low with the majority being of average ability.

2. Susan and six grade three students. Susan taught a grade six class the majority of the time, but at the time of the research project was also working with six students, both boys and girls, of above average ability [as determined by their teacher]. Since there was no set materials she needed to cover with these students, she wanted to involve them in the Logo project.
3. Christine had a class of seven Trainable Mental Handicapped (TMH) students. TMH students are defined as mentally handicapped but have the potential to learn self-help tasks, basic communication skills, some functional academics, basic daily living skills, and vocational skills (Snell 1978 p. 46). While these 7 students were in the computer laboratory, there were 2 adult aides present as well as Christine. The two aides followed the instructions and example of Christine. These students ranged in age from ten to 15 and included both boys and girls.
4. Carol and her class of 12 TMH students. These students are similar in ability level to Christine's but are younger, ranging in age from six to ten. Although there were 12 students in the class, there was not a computer period when all 12 students were present. There were two aides with the class and often one aide would be in the classroom working with some of the students while Carol and the other aide were working with the rest of the students on Logo.

None of these teachers were familiar with Logo prior to this study. Three of them had never heard of it and Susan, while knowing it had something to do with computers, knew nothing specific about it. The first three teachers had not worked previously with computers while Susan was involved with teaching the Computer Literacy courses taken by the students in grades four to six

SETTING OF STUDY

All of the classes involved in this Logo study were held in the school's computer laboratory. The computer lab was located on a second story loft that overlooked the school library. It was open to the library, with an iron railing along the open side of the loft. Access to the computer lab was through a door opening in from the second floor hallway, or up a stairway from the first floor library. There were ten Apple II E computers in the lab, arranged in groups of three, the tenth computer being on a separate table and connected to a television monitor mounted on a high stand, and an Imagewriter printer. [See map of laboratory in Appendix B.] There were three other printers connected to various computers but were never used in any of the Logo sessions. The computers, grouped in threes, were so arranged that each student could work at a computer without being able to view the keyboard and monitor of the other computers in that group.

RESEARCHER INVOLVEMENT

Within this project the researcher assumed two different roles.

Role 1 Researcher as Assistant to the Teachers

An initial workshop session, conducted by the researcher at the elementary school, was held with the teachers and administrators who were interested in the Logo study. This workshop was conducted to give assistance to those teachers who felt they needed help in establishing a basic familiarity with the Logo language. Since none of the teachers had a working knowledge of Logo, all four teachers took part in this workshop at one time or another.

The initial inservice was held on the afternoon of a Professional Development day for the entire staff of the school. This was done at the request of the principal, so that it would be available to any teacher or administrator who wished to attend. Eight teachers and administrators were present. I explained briefly that Logo is a computer language created by Seymour Papert to be used in an educational setting. It was stated that Logo could, and had been used with students ranging in age from a kindergarten level to university level. Through having the people physically move forward, backward, turn left and right, the four basic Logo commands were introduced and demonstrated. The participants then went to the computers where they were shown how to insert the Logo disk into the disk-drive and turn on the computer. Using the

four commands already demonstrated, they were asked to explore and see what they could do with what they knew. As they worked, I walked among them answering any questions they had. A conscientious effort was made not to demonstrate any particular method or way to accomplish the graphics they wished to draw, but rather, they were shown what a particular command could do, and then they were encouraged to explore what they could do with that command. If a request such as "How do I erase just one line instead of the whole thing?" was made, the person involved was shown how to accomplish the task. None of the teachers worked beyond the level of using basic commands -- meaning that none of them were introduced to writing procedures. Christine, Carol and Susan attended this inservice -- Raylene did not because of illness. Raylene was given this same information and hands-on time on the computer at an after-school session arranged by her and myself.

At the time of the inservice, no one indicated that they would definitely participate in the study. Carol, Christine and Susan indicated interest but wished time to consider it. The following week they requested that they be included in the study.

Subsequent to this workshop, the researcher assumed the role of assistant resource person to the teachers as they developed Logo with their students. Careful, conscientious and continuous attempts were made on the part of the researcher not to influence the teachers' selection of methods, approaches or materials. A selection of books and manuals pertaining to Logo [see Appendix A for list of

books] were presented to the teachers and principal. These books were left with the principal and the teachers obtained these materials from him as they desired. When the teachers directly requested the researcher to make choices and/or decisions as to their usage of Logo, alternative methods were suggested in order that the decision be the teachers' and not the researcher's. While this method has the potential for limiting the choices made by the teachers to only those selected by the researcher, extensive effort was made to refer the teachers to the books and materials available, so that a broader selection was available.

Role 2 Researcher as Ethnographer

A. In the Classroom

The study extended over a four month period during which time each child spent a minimum of 30 minutes in the computer lab per week. The researcher was present during these sessions, as well as being in the school on several other occasions to talk with the teachers and to be available if the teachers had questions or wished help in specific areas.

Using ethnographic methods, data was gathered through participant observation of Logo classes, field notes, tape recorded formal interviews, and documented interactions with the teachers. These interviews and discussions gave the researcher access to the

teachers' feelings and concerns about Logo implementation, individual philosophies and interpretations of Logo that led them to implement Logo in the ways they did. Insights were gained through discussions with the teachers concerning their personal biographies as they pertained to the ways that they affected the approaches taken in Logo implementation and computers in general. Through discussions and interviews with teachers, knowledge of Logo-related activities that took place at different times and/or locations than those the researcher observed, were obtained.

B. In Teachers' Evaluation Session

At the termination of the designated time period, the teachers and the principal met together at the request of the researcher, in order to evaluate and discuss their experiences with Logo, and to make plans with regard to Logo, for the upcoming school year. This session gave the teachers the opportunity to discuss what had happened during the research project, to take a closer look at why they thought certain things did or didn't happen, to explore together the various methods and approaches they used, and to draw up guidelines for the direction they felt Logo should take in the future in their classes/school. The purpose and aim of holding such a session was a hope on the part of the researcher that during this session the underlying perspectives or assumptions of the teachers "Logo culture" would surface as points of review were compared, defended, modified and proposed as bases for future plans. This

session was tape recorded and the information used as part of the data base.

DATA ANALYSIS

A systematic examination of the Logo setting as it was developed by the teachers was explored using ethnographic methods. This analysis enabled the researcher to determine its parts, the relationships among those parts, and their relationships to the culture as a whole and to concerns expressed by Papert.

The data, written up as case studies, was returned to the teacher, for their verification as to the correctness of content and implications.

This ethnographic analysis helped provide awareness of concerns expressed in Research Question Aspect A; formed the basis for making comparisons to the Logo philosophy as expressed in Mindstorms, Aspect B; and shed light on the particular concerns and applications of Logo in a special education setting, Aspect C.

CHAPTER THREE

REVIEW OF LITERATURE

While the use of computers in business is a common everyday occurrence in most countries, their inclusion in the educational realm is still comparatively new and limited. Heralded as the miracle educational tool of the future, many schools have quickly purchased hardware and software. Worthwhile and knowledgeable use of these components has been later in coming, or, in many places such use may yet be in the future. The creation of the Logo language for educational use is an even more recent addition. While some work was being done with Logo in the mid 1960s it wasn't until 1970 that Seymour Papert developed a robot turtle that could be manipulated by means of Logo commands. Until this time Logo was not being used outside of the research laboratories. Early educational use of Logo used the robot turtle but since that time a symbolic turtle that appears on the computer monitor and is easier to manipulate, has come into being. The first implementation of Logo was done in 1967 at the research firm. However, the first educational use was after the development of the turtle. The research was run at a junior high school in Lexington, Mass. and concentrated on grade seven language arts applications only (Wood 1984 p. 1).

Because Logo has existed for such a short time and has been used in the schools for an even shorter time period, long-term

research on the usage and effects of this computer language are not available. "The value of long-term use of Logo is a more open question. I am aware of no extended studies of children using Logo." (Higginson 1982, p. 328) Educational journals and magazines currently abound in reports, primarily anecdotal in nature, from teachers and/or administrators, kindergarten to University level, as to how Logo is being used in, and under, specific conditions. They report on merits or shortcomings they have encountered in Logo as they have observed its usage in their schools. However, very little research has been done and documented on Logo implementation with a focus on the teachers' interpretations of Logo philosophy, their selected approaches to using Logo and their methodologies in implementing Logo in classrooms in today's school systems.

The most frequent use of Logo is at the elementary and junior high level, with studies and experiments ranging from a whole school [the Lamplighter School in Dallas, Texas] to single classes in schools all over North America and in Scotland. Watt, D. [1982, Aug.] lists four major projects, each in a different type of school and with different emphasis and structures. (Wood 1984 p. 7)

These major research projects are the Edinburgh Logo Project, the Brookline Logo Project, the Lamplighter Project and Computers in School Project. Each of these research projects were set up to prove or illustrate the feasibility of a preconceived idea of how Logo could [or should] be used.

One of the earliest documented studies using the Logo programming language was the Edinburgh one, carried out through the Department of Artificial Intelligence at the University of

Edinburgh in 1976. (Howe, O'Shea, and Plane) The exploratory and self-directed aspects of Logo were kept at a minimum. The focus was the development of mathematical skills and the acquiring of mathematical concepts. This was a two year study in which eleven low-ability mathematics students in a private school's sixth grade were grouped in a special class at the University. These boys came to the University laboratory for an hour a week, throughout the school year. The first year they worked through graded work sheets from which they learned the basics of Logo and the second year they did Logo exercises designed around selected topics in their mathematics curriculum. The results were "not very dramatic from the aspect of subject mastery, the main difference noted, being that the experimental group were more willing to argue sensibly about mathematical issues and to explain their mathematical difficulties clearly (Watt 1982 p. 116). These results may not carry a great deal of weight though, because as Watt remarks, "This finding may have depended as much on the teaching approach used by the Logo teachers, as compared with the classroom mathematic teachers -- and on the individual assistance the Logo students received, as it did on the Logo activities themselves." (Watt 1982 p. 118)

The Brookline Logo Project in Brookline, Mass. involved a group of fifty sixth grade students who were placed in a computer laboratory in the school. Sixteen of these students were selected for intensive study (Papert, Watt, de Sessa and Weir 1979). This cross-sectional group was monitored closely as they learned Logo, the emphasis being on the learning styles the students employed. In

contrast to the highly-structured Edinburgh study, this program followed Papert's philosophy of "child programming the computer", and not vice-versa. Since Seymour Papert was one of the organizers of this project it is not remarkable that such a philosophy was evident. The results of this study were very dramatic in the affective domain with the students showing great enthusiasm and interest in the project, but it was not possible to provide 'hard data' in the area of objective test results, as tests to measure Logo-using ability have not yet been devised. All the students were successful in using Logo, and enjoyed the experience (Watt 1982 p. 123).

From this project, and a second one conducted in the same school using, as assistant instructors, students participating in the first project, it seems clear that the students learned a great deal about Logo and how it could be applied in several curricular areas. What is not known is if the knowledge was transferred to these curriculum areas.

Computers in the Schools Project implemented in 1980 and continuing into 1983, in New York, had a philosophical basis similar to that of the Brookline Project. In this project the teachers had extensive training. The emphasis of this project, which involved students from grades two to nine, was on the social and interactive developments that working with Logo produced in the students, rather than improvements in mathematical achievement and gains in the cognitive domain. The project co-ordinator Michael Tempel stated that "The positive educational benefit was obvious! Kids were

engaged in valid intellectual and social processes. You could see them developing... We have seen striking changes in kid's relationships to schools and learning; kids who had not been successful in school get turned on." (Quoted in Watts 1982 p. 130)

In 1978, an extensive study of Logo was conducted at the Lamplighter School in Dallas, Texas. Lamplighter is a private school consisting of pre-school and grades one to four. This study, established by the creators of Logo at M.I.T., involved all the students and teachers. For a year the staff was trained in the usage of the Logo language. Logo was then introduced to the students (Overall 1981 p. 42). "This private school, founded in 1953, has no report cards, rings no bells, and allows children to learn at their own rates, competing only with themselves....the feeling that pervades the entire system is that each child is unique and individual... The purpose of the school is to ensure that, through high academic standards, the children will develop skills that will help them cope successfully with the world in which they will live -- a world we cannot predict. Therefore, the concern is with teaching a way to think and, at the same time, teaching the child to believe in himself." (Lola 1981 p. 43)

The results of this study indicated that Logo usage aided in individualization, promoted improvement in an individual's self-concept and peer-relations, aided in the ability to communicate, and helped students see the worth of themselves and of their classmates in new and different ways (Overall 1981 p. 42).

It is interesting to note that both the Brookline and the Lamplighter Projects were set up in such a manner as to be in a no-lose situation as far as showing the benefits and success in using Logo. Both projects were either organized, or sponsored by, the M.I.T. group that created Logo and the projects were carried out in schools that were based on the same educational philosophy as Logo. If one is trying to bring out, develop and test the dimensions and potential of Logo this is a logical way to do it. However, while these three [Brookline, Computers in School, and Lamplighter] research projects report glowing successes in the usage of Logo, one must be aware of the circumstances under which they were carried out, and take these circumstances into consideration in evaluating the results of the studies.

Therefore, research needs to be carried out in classrooms with teachers who are not specially picked to match the Logo philosophy of education. This concept of attempting to document what happens when 'ordinary' teachers interpret and implement Logo is one shared by David Moursund. In an issue of Computing Teacher he comments

First I fear that Logo is being oversold. Some people are developing unreasonable and unrealistic expectations about what Logo can do and what it will do for Education.

Second, I fear that Logo will not reach its potential... In talking with many Logo-oriented educators, I am led to believe that Logo will not only make their students computer literate, but will also make a major contribution to rectifying many of the current ills of education...such...beliefs in Logo go largely unsubstantiated.

Indeed, few of the so-called experiments have been done making use of 'ordinary' teachers -- those with a very modest level of training, experience and interest in the computer field.

The very heart of much Logo-based instruction is what is often called discovery-based learning. Discovery-based learning has been extensively researched and has substantial merit. But its effective implementation requires well-trained, skilled, committed teachers. Logo by itself cannot create the teacher-related basis of a sound educational curriculum (Moursund 1983-84 p. 3, 4).

Wood, in his Logo Literature Review, states "Given the innate conservatism of educational systems, Logo will, I think, certainly be used as another instructional resource by teachers, though it will not have a major influence on curriculum philosophy and design" (Wood 1984).

This research will shed some light on what happens when "ordinary" teachers implement Logo, and perhaps also on any influence it may have on the curriculum.

CHAPTER FOUR

DATA -- FOUR CASE STUDIES

CASE STUDY NUMBER ONE -- RAYLENE

Introductory Session -- March 21

Upon arriving at the elementary school a period before Raylene's first Logo session with her class, I found Raylene in the computer lab booting up the computers with her Logo disc. This was her preparation period and she said she wanted to make sure everything was ready for her class when they came up for the first time. As she went around to the computers to boot them up she said, "Do you realize that this is the first time I've ever done this?" Raylene had been ill when the inservice was given to all the teachers who were interested in participating in this Logo project, and therefore had been unable to attend it. She and I had met after school on a day previous to this first day and we had gone over the basic Logo commands -- Forward, Backward, Right and Left. I had booted up the computer before she had arrived that day and consequently she had never had to deal with the mechanical task of putting in the disc and turning on the computer.

After making sure that all the computers were working and after having loaded Logo, Raylene went back to her classroom to get

her grade two class. In a few minutes the 23 students came hurrying up the staircase to the computer lab which was located in a loft above the library. There were smiles on their faces and they were in a hurry to get to the computers. The students started to mill around the computers.

RAYLENE: Everyone find a place at a computer. There are to be two students at each computer. Jimmy, there's a place over here. Sally, you can't sit there, there are already two people there. Go sit over there with Sarah. David, you'll have to sit here with these two because there are not enough computers for everyone.

The students sat down in front of the computers and several of them started pushing the computer keys.

RAYLENE: Don't touch anything. Just listen. There are several things we need to know before we use the computers. Logo is a different language -- we'll use different words and instructions in order to make it work.

The students kept shifting around on their chairs, trying to push various keys on the computers and whispering to each other. They seemed very excited and anxious to do something on the computers.

RAYLENE: Just listen and don't touch the computer. The first thing we need to know is the parts of the computer. This is the monitor, this is called the disc drive and this is the keyboard.

[Raylene pointed to each item as she told the students what they were.] You don't have to put a disc into the computer because I've already put the Logo disc in. We talked in the classroom about what we have to do when we want to tell the computer what to do. What do we do when we want to talk with the computer?

STUDENT: You push the keys.

RAYLENE: That's correct. We are going to be working with a shape that is called a turtle. You will see it on your screen and the turtle will move around. The person in front of the computer is to push the keys and the other person is just to watch quietly. Push the keys ST to see the turtle.

The students in front of the computers looked for the S and T keys. Several of the students who were supposed to be watching tried to help them by either pointing to the keys, or telling them where the keys were or reaching in front of the student to press the keys themselves. In time everyone found the keys and pressed them but nothing happened on the screen.

RAYLENE: I forgot to tell you to press RETURN. You always have to press RETURN after telling the turtle what to do.

The students in front of the computers, with the aid of their companions found and pressed RETURN and the turtle appeared on their screens.

RAYLENE: Only the person in front of the computer is to push the keys. The rest of you don't touch them. Just watch. You'll have a

turn later. We are going to learn four commands. Forward, Backwards, Right and Left. Push the keys FD and then RETURN.

After a certain amount of looking and talking, the students found the keys FD and pushed them. Some of them held the keys down for too long and got FFFFFFFFFFDDDDDDDDDDDD instead of FD. Others hit the wrong keys. Raylene walked around among the students and helped them find the correct keys, until everyone had typed in FD. Nothing happened on the screen.

RAYLENE: Nothing happened because we have to tell the turtle how far to go. Now type in 50 after the FD.

After searching for the correct keys for numbers, the students typed in 50, the same problems occurring with the 50 that had occurred with the typing in of FD. As the students found the correct keys and pushed them there were squeals and giggles as the turtle moved the 50 steps. Raylene then instructed the students to type in RT and see what happened. Nothing did.

RAYLENE: Nothing happened because we have to tell the turtle how far to turn. Put in 60 after the RT.

The students went through the same process of searching for keys, hitting wrong ones, holding them down too long, and trying to stop the observing student from helping them.

RAYLENE: Now we want to make the turtle go forward again. What do we have to do?

STUDENT: Push FD.

STUDENT 2: Tell it to go 50.

RAYLENE: That's right. Type in FD 50.

Some students found the keys quickly and the turtle went 50 steps, others couldn't seem to find them and either sat looking at the screen while the watching student tried to tell them what to do, or waved their hand to get help from Raylene. One student typed 550 instead of 50 and starting laughing when the turtle went wrapping around the screen. Raylene went around to the students to help them find and push the right keys. Everyone got their turtle to go 50 steps.

RAYLENE: Class, we are going to be making pictures or designs by telling the turtle what to do. We are not going to do math, or social or anything else because that's not what Logo is for. If the design is really good, maybe you can do houses or pictures. Now it's time to change places in front of the computer. First, type in CS to clear the screen. [This was accomplished.] Now, type in HOME to bring the turtle back to the middle of the screen.

The students worked at accomplishing this. There were a lot of giggles and students trying to help their partners when the turtle returned home and left its trail on the screen.

RAYLENE: This is new to me, too. This will give me a chance to help you. Type in CS to clear your screen and get rid of the turtle's trail. Then trade places in front of the computer.

—The students did as they were instructed and Raylene worked with the second group of students. The same type of procedures were followed with the second group as with the first group. Raylene continually reminded them to let the person in front of the computer push the keys and to be quiet in order that they could hear her instructions. The whole class completed one instruction before another one was given. At the end of the period, Raylene told the students to type in CS so that they could leave a clear screen on the computers. The class left and since it was recess, Raylene stayed to discuss with me her first session with the class and Logo.

RAYLENE: They didn't get as far as I thought they would. It was so noisy that they couldn't hear my instructions and they got behind.

Raylene had been talking to one of the teachers who had decided not to participate in the Logo project and continued the conversation by referring to this teacher.

RAYLENE: She doesn't see this [Logo] as learning, but I do. If nothing else, the students will learn how to turn on a computer and follow directions.

RESEARCHER: I guess that whether you think learning was taking place depends on your definition of learning.

RAYLENE: That's right. And I think that the students are learning.

Raylene continued to express her concern about the noise level and the difficulties the students had in locating the keys.

IMPLEMENTATION

Session No. 2 -- April 4

Before the class came in view, you could hear their excited voices as they came running up the staircase into the computer lab for their second Logo session. They rushed around trying to find themselves a place at a computer with their friends. There were two extra students this session who had not been there the first time, so there were three computers with three students working at them.

RAYLENE: What do you call the figure in the middle of your screen?

STUDENTS: Turtle!

RAYLENE: Does he look like a turtle?

STUDENT: No, he looks like a rocket ship.

RAYLENE: We have to give the turtle commands. How do we do that?

STUDENT: By pushing keys.

RAYLENE: We're going to make the turtle go forward. Put in FD and then a 50. Only the person behind the computer is to push the keys.

The task was accomplished quickly by some, with difficulty by others, and not at all by others. The watching students tried to help the students in front of the computers carry out Raylene's instructions.

RAYLENE: Can you make him turn?

STUDENT: Yes.

RAYLENE: What direction do you want him to turn?

STUDENT: Right.

RAYLENE: If you want him to turn right what do you have to do?

Raylene continued with this type of questioning and reviewed with them how to make the turtle go forward and turn. The students were asked to type in various numbers after RT in order to see what happened. Raylene went around to the students' computers and helped them to find the keys they needed, or repeated her instructions for those who had forgotten them or hadn't heard them. Everyone completed her instructions.

RAYLENE: How do we get the turtle back where we started?

STUDENT: Put in HOME.

RAYLENE: That's right. How do we spell HOME?

Raylene went around the room helping students spell and enter the HOME command correctly. This took quite a while as the students seemed to be having a lot of difficulty spelling HOME and entering it correctly.

RAYLENE: What does the HOME command do? What happened when you put it in? [Students indicated what the HOME command did.] In order to draw, we have to count the number of degrees the turtle turns. How do we clear the screen?

STUDENT: Push CS.

RAYLENE: Let's try to draw a house.

The students worked on this for a few minutes and then Raylene announced that it was time to change partners.

RAYLENE: Let's clear the screen before you change partners. What do you do to clear the screen? Is your turtle home? What do you have to do to bring him home? Type in HOME. How do you spell HOME? When you get that done, change partners.

The same type of questioning and instructions were done with the second half of the class.

The next several classes followed a similar pattern -- the commands that the students had previously worked with were reviewed through Raylene asking the students questions like, What would you do if you wanted the turtle to do various things? After the students gave their answers, they were asked to type in that command and whatever number Raylene asked them to enter. They drew squares and rectangles. Some students were able to complete these figures on their own, while others waited for Raylene to give instructions as to how far to have the turtle travel and how far to make it turn. The class stayed together in their work in as far as the whole class was to complete a square or rectangle or whatever they had been requested to draw, before further instructions were given.

The noise level was of concern to Raylene. It concerned her because the students couldn't hear her instructions and some of them would get behind and didn't know what to do. As a consequence Raylene had to continually circulate among the students repeating her instructions and showing students how to carry them out. She was also concerned about what she should be doing with the students and also about the fact that the students didn't seem to be able to understand how much to turn the turtle in order to draw squares and triangles.

Session No. 4 -- April 11

After the fourth session, Raylene met me in the hall before a class and said she had been looking at the book Turtle Source.

RAYLENE: It has some good ideas. I think I'll use it to follow. I think I'll let the students play around for a while and see what they can do. They have such a hard time understanding about angles so I think I'll try relating them to the clock because we're talking about minutes and hours and they may make sense to them because angles don't.

Another area of concern to Raylene was the fact that the students had such a hard time and took so long to locate the keys that they needed. She mentioned that she was thinking of drawing a diagram of the keyboard so that the students could practice at their desks. Since I had a diagram of the keyboard in a computer manual, I gave it to her to use. She enlarged it so that it was approximately the same size as the actual keyboard and each student was given a

copy. During the time when they were not in the computer lab, Raylene had the students practice finding the keys on their diagrams.

At the first Logo session after the students had been using their keyboard diagrams in their classroom:

RAYLENE: Let's begin by drawing a square. Remember all four sides are the same. Let's go FD 60 for the sides.

Many had trouble drawing a square, so Raylene helped them by either telling them what to do or typing it in for them.

RAYLENE: Now type in PU. Go FD 20. Remember, we practiced the command PU and PD in the room on our sheets. [To a student.] No, you went FD 60 and I asked for FD 20. You're not listening. Next time I'm going to write out the lesson and not even speak. We practiced finding these keys in the classroom -- you should be able to find them. Put in PU FD 20 and then we're going to draw a rectangle.

Several more sessions followed this pattern of questioning the students how they would do certain things or give certain commands, and then Raylene gave instructions as to what they should enter on the keyboard. When the students could not carry out the instructions, Raylene would help them by repeating the instructions or typing them in. Squares and rectangles were drawn in various sizes and locations on the monitor, using the basic four commands and PU and PD. Some students were working very quickly and carrying out instructions as quickly as they were given while others were having difficulty.

Session No. 6 -- May 16

After the sixth Logo lab session, Raylene talked with me about her concern regarding the difficulties of having two students working at each computer.

RAYLENE: I think I'll only have one person on the computer and the others will sit away from it and do something else. They keep interfering with the person at the keyboard. And it gets so noisy they can't hear the instructions.

RESEARCHER: I have seen some teachers work it that way. Half of the class works on the computers and the other half bring books or other work with them that they do until it's their turn at the computers.

RAYLENE: I think that's a good idea, but I think what I'll have the waiting students do is draw out on a piece of paper what they want to draw on the computer. I want to go on to triangles now, but if they can't figure out how to draw squares, how are they going to draw triangles? Some of the students though, seem to have gone beyond the mechanics of the four commands and are starting to think about what they are doing. But a lot of them still can't seem to be able to do the four commands.

After this discussion, the class was divided into two groups -- one group worked at the computers and the others brought puzzles, word searches, books and other materials and worked on them on one side of the room. Raylene worked with the students on the computers and the other students were to be quiet and do their

work without disturbing the ones working on the computers. The following took place at the first session after the class was divided:

RAYLENE: I want you to draw three squares on your screen. Use PU and PD in order not to leave lines between your squares. Go ahead and draw them on your own. [Several students did this very quickly and Raylene talked to them.]

RAYLENE: Since you are finished, we'll draw a triangle. How much are we going to have to turn the turtle to draw a triangle? [Several students guessed different numbers.] How many sides does a triangle have? [Students replied, "three."] Since a triangle has three sides, we need to divide 360 by 3. A circle has 360 degrees. We need to divide 360 by 3 because a triangle has three sides and 3 angles. We need to turn 120.

The students started to draw a triangle. The majority seemed to encounter difficulty and had their hands up for help.

Raylene: Grade two, this is impossible unless we all stay together. Everyone erase their screens. Go FD 75. We only have three angles so 360 needs to be divided by 3. Go RT 120, FD 75. What do you have to do now to get the turtle to turn and join the other line? Those that know how to do it, do it. [Short wait.] We have to turn 120 degrees. Turn RT 120. Do you understand? We need to go forward three times and turn three times because it is a triangle.

The students worked for a short time on drawing triangles while Raylene walked around and helped them. Then they cleared their screens and the groups traded places and the same type of pattern was followed with the second group.

After this session, Raylene told me that she had read about the REPEAT command in the book she was using and wanted to teach it to the students because it looked like it could do a lot of exciting things. She asked if I could explain it and show her how to use it. She wanted the computer to draw a square, turn it and repeat it 10 times. She wanted to know how to get the computer to draw a square on its own so that it could be repeated. Since we were in the lab, I explained what a procedure was and showed her how to write one in order that the computer would draw a square when 'square' was typed in. Then I showed her how to use the REPEAT command along with a procedure to accomplish what she wanted. She indicated that she would teach the students both procedures and the REPEAT command the next session and asked if I thought that was too much to do. Since the combination of teaching the two concepts at once seemed rather overwhelming, I suggested she work on the REPEAT command and I would enter a procedure into the computers so that it would draw a square when the students typed in the word 'square'. She indicated that she thought this would work very well.

Session No. 7 -- May 23

While working with Raylene in the lab on the REPEAT command, I had written REPEAT 10 [Square RT 45] on the blackboard to help her see what she needed to enter into the computer. When the class arrived for the next session, Raylene explained that they would be working with a new command -- REPEAT.

RAYLENE: Today, we're going to work with a new command. It does some interesting things. The command is REPEAT. I want you to type in REPEAT 10 [Square RT 45].

There was a babble of voices as the students tried to type in the instructions that Raylene gave them. Just then Raylene looked at the board where we had written the instructions the previous afternoon when she and I had been working on the computers.

RAYLENE: Look at the board. What you have to type in is on the board. Put in what it says on the board. What happened when you typed it in? Now clear your screen and do the same thing again, but change the number that follows the REPEAT and see what happens.

STUDENT: Can we change the number after the RT?

RAYLENE: Yes. Try changing both of them and see what happens.

After this session, Raylene often wrote her instructions on the board and the class seemed to have less difficulty in remembering her instructions and completing them. The class continued to work in two groups and Raylene felt that this was a much better arrangement. She thought that the group at the computers were getting a lot more done. The fact that there were not enough computers for half of her class caused her a lot of frustration as there were extra students that didn't get a computer when the two groups changed places. The noise level during the class also was of concern to her. She felt that the students on the computers weren't able to hear her instructions and therefore it took them so long to get things done.

Session No. 9 -- June 6

At the end of the Logo sessions, Raylene and I discussed her feelings about Logo and how her classes had gone.

RESEARCHER: In general, how do you feel about your experience working with Logo?

RAYLENE: I enjoyed it. It was a good way to start young children on computers. It gave them a chance to explore on their own. If they make a mistake it's not like in math or spelling. They can correct it themselves. I wasn't too sure of what to expect but I think it helped students to define shapes -- to sort them out and to make them. The really frustrating thing is that they didn't have time to get used to using computers before they had to use Logo. It was a real problem with grade two. It would have helped me more if I knew more about it -- I didn't spend enough time to know what was going on. Maybe after you master the basics you can be more inventive. But I think it was really valuable time spent because they did learn to operate the computers. The students had such a hard time finding the keys because they expected them to be in order. Maybe next year I'll have a model and have the keys practiced before they get on the computers or maybe I'll get a typewriter and let them practice on it.

I did what I felt the students were leaning toward -- I wanted to see them accomplish things for themselves. I did things the way I felt I should for the students to learn as much as possible. Next year, I'm going to start early. I'm going to work in three groups as

I'll have 25 students. We'll work through the directions and problems in the classroom first and then the students will be more prepared and get more done more quickly and they will feel that they have accomplished more.

RESEARCHER: Did you teach the Logo classes in the same manner or style that you taught the rest of your classes, except of course, that you were working on computers?

RAYLENE: No. It was different in the computer class. The class was so anxious to work on computers. Then, of course, only part of the class was participating. One half of the class was disturbing the other half when they were trying to work on the computers. The students were too excited about the computers. They were nervous as well as excited because they didn't know how to use the computers or know what to do. Then they got frustrated easily because they couldn't run the computers. I'd like to see how much further the students could go once they know the basics.

It was a good experience because I was anxious to learn for my own sake and I was anxious to teach the students. But I needed to know more before I tried to teach it to the students.

CASE STUDY NUMBER TWO -- CHRISTINE

Introductory Session -- March 15

While travelling to the school for the first session of Logo with Christine and her TMH class, I felt rather anxious and also frustrated as Christine had given no firm commitment to participate in this Logo project and therefore it was questionable whether there would be a first session. Upon arrival at the school I went to Christine's room to discuss her plans in regard to working with Logo with her students.

RESEARCHER: Christine, after the Logo inservice we had last week, I wasn't sure if you were interested in participating with your class in our Logo project.

CHRISTINE: Oh yes. We planned on doing it. Do you want us to start today?

RESEARCHER: If you have time now, it would be terrific, as I'm here and available to work with you.

CHRISTINE: Give me five minutes and I'll be up. [To the lab.] Mr. B. [her principal] gave me this disc that is supposed to have some sort of shortened Logo on it, but I haven't had time to look at it. But I thought I'd like to use it because I don't think my students will be able to use the regular Logo.

RESEARCHER: If you like, I'll boot up the computers for you with the shortened version and have them ready by the time you get to the lab.

In trying to use Christine's disc, I discovered it was a regular version of Logo and not a shortened one. When Christine and her class of 7 students arrived, I explained this to her and told her that if she wanted, I could prepare an Instant version of Logo in five or ten minutes. She said that would be really good as she was certain her students couldn't use the regular Logo. While I was doing that, she and her two aides collected the students around one of the computers and Christine talked to them about computers and the places where they might have seen one and some of the things about computers. She explained that you talk to the computer by pushing the keys and when you push the keys, something will happen on the screen. The students were quiet during her explanation, but they seemed excited or anxious or nervous, as they kept shifting and moving around.

By this time, I had loaded an Instant Logo version into all of the computers. The Instant version allowed the students to manipulate the turtle through the use of single letter [key] commands. Pushing the F key would move the turtle 50 steps forward, pushing the B key would move the turtle backwards 50 steps, the S key would draw a square and the T key would draw a triangle. [See Appendix D for complete functions of this Instant Logo version.]

CHRISTINE: Do you see this triangle in the middle of the screen. This is called a turtle. By pushing the keys, we can make this turtle move forward and backwards. We can make him turn right and left and we can make him draw squares and circles and many other things. Let's make him go forward first. What sound does the word

Forward begin with? [Several students made the FFF sound.] That's right. Now what letter makes that sound?

STUDENTS: F.

CHRISTINE: That's right. Can any of you find the F key on the computer?

The students all crowded closer around the computer and looked for the F key. One of the students located it and pointed to it.

CHRISTINE: Good. That's right. Roger, will you push the key. And the rest of you watch the screen and see what happens when Roger pushes the key. [Roger pushed the key. Nothing happened.] After you push a key to tell the turtle what to do, you always have to push this RETURN key. [She pushed it.] What happened to the turtle?

STUDENT: It moved.

CHRISTINE: Good. That's right. The turtle went forward, didn't it? Whenever you push the F key, the turtle will move forward. Now, let's make the turtle move backward. When you say the word Backward, what sound does it begin with?

STUDENT: DD.

STUDENT: BB.

CHRISTINE: BB is right. Can you find the B key on the computer?

Students crowded closer to see the keys, but no one seemed to be able to locate the B key.

CHRISTINE: Is the B key on this row of keys?

Students found the B key on the bottom row of keys.

CHRISTINE: Sandra will push the B key and the rest of you will watch and see what the turtle does. Remember to push the RETURN key after you push the B key.

CHRISTINE: What happened to the turtle?

STUDENT: It moved.

CHRISTINE: It moved backward, didn't it? Whenever you push the B key, the turtle will move backward.

Christine followed these same steps to introduce and demonstrate the drawing of a square, a circle, a triangle and a sun. The students talked, made noises and pointed to the monitor as the turtle moved and drew the various figures. They all wanted to find the keys and push them. After demonstrating these movements:

CHRISTINE: Now, what do you want the turtle to draw?

STUDENT: A circle.

CHRISTINE: All right. In order to get the turtle to draw a circle, we need to push the right key. What sound does Circle start with?

STUDENT: SSSS.

CHRISTINE: It does sound like a S sound, doesn't it. But Circle actually starts with a C. Where is the C key on the computer? [Students located it.] Will you push it, Jane? [Jane pushes CCCC and nothing happens on the screen.] No, Jane. In order to get to work, you have to only push it once and then take your hand away. Like this. [Shows her how.]

Christine worked for a few minutes at the computer with all the students, asking them what they wanted the turtle to draw, what sound it would start with, where the key was located. She had them

push the key and pointed out what happened on the screen. The students were then sent in pairs to the computers with an aide or with Christine to sit at the computers with them to help. One student was by himself at a computer. Christine worked alternately with one set of students and with this student.

CHRISTINE: [Working at a computer with two students.] All right, Roger, what do you want the turtle to draw?

ROGER: A sun.

CHRISTINE: What sound does Sun start with? [Roger answered S.] That's right. Can you find the S key? [Roger found it.] Push it and then push the RETURN key. Watch the screen to see what the turtle does.

Students laugh and point to the screen as the turtle draws the sun.

CHRISTINE: Now, Roger, what else do you want to draw in your picture?

ROGER: A sun.

CHRISTINE: We could draw another sun, but why don't we draw something else? We can draw a square or a triangle or a mountain.

ROGER: A mountain.

CHRISTINE: All right. What does Mountain start with? [He tells her M.] That's right. Can you find the M key? [He can't.] Is the M key on this row of keys? [Roger finds it and pushes it.] Now, you need to push the RETURN key. Watch the screen to see what the turtle draws. It drew a mountain didn't it.

Christine and the aides worked with the students following this pattern of asking the students what they wanted to draw and what

sound it started with. She had them locate the key and push it. Then she told the students what the turtle had drawn. This lasted another few minutes until the end of the half hour class.

CHRISTINE: We are going to save your pictures and print them out for you. Each of you needs to think of a name to call the picture that you have drawn. [To students she was working with.] What do you want to call your picture? [No response.] Do you want to call it your name? [Both students answered, yes.] Roger, can you spell your name? You push the keys to spell your name. [With several mistakes and guidance from Christine, he does this.] John, [The student working on the other computer with Christine.] can you push the keys to spell your name? [John can't. Christine types it in for him.]

After saving the pictures on a disc, Christine brought the discs over to the printer and I showed her how to run the pictures off. The students all crowded around the printer. They laughed and pointed and talked as the pictures came out of the printer. At the beginning of the printing of each picture, Christine told them whose picture it was and asked that particular student to watch as their picture was printed. Their names were put on each printed picture and each student was given his/her picture. They seemed very excited to have this printed picture. They all thanked me and returned to their classroom.

IMPLEMENTATION

Two more sessions of Logo were conducted in a very similar manner to the introductory one. The students worked in twos at the computers with Christine or an aide to assist them. The line of questioning followed the pattern established in the introductory session. Pictures were saved under whatever name the students wished to call them [They all wanted their own names.] and were run off on the printers. The students took the printed pictures with them.

Session No. 4 -- April 19

When the students came into the lab for the fourth session, they seemed very excited. They were each carrying a sheet of paper and each headed for a separate computer. On each sheet was printed the letters of the commands and the shapes each letter[s] would draw. [See Appendix D for Sheet.]

CHRISTINE: Today, I want you to see what you can do on your own. Use your sheets to help you remember what the turtle can draw and what letters you need to push in order to get the turtle to draw it. Mrs. B., Mrs. J., [the aides] or myself will be around to help you if you need it.

The students picked out from the sheet what they wanted to draw. Some students worked almost entirely on their own. Others would push one key and then sit and not do anything else. Christine and the aides went around and helped them if they asked for help or

if they seemed to be doing nothing. Sometimes they helped the students locate the needed keys or identify the letters they needed. If a student seemed stuck and wasn't doing anything they would be asked

CHRISTINE: What do you want to do now? [No response.] Do you want to draw a sun or a triangle? What you have done looks really good. What do you want to do next? [To another student] You can do whatever you want. What is it that you want to draw? Let me show you how to draw a sun. You push the S, U, N keys, like it shows you on your sheet. There, that's how the Sun works. Now, you try doing it yourself.

Mr. B. [the principal] had given Christine another Ez Logo disc. She wanted David to try it. So she loaded it into his computer and David tried to move the turtle through a maze that appeared on the screen. The commands in this program were similar to the Instant Logo the students were using, in that they were one-key commands to move the turtle. Pictures were saved on a disc and run off on the printer for the students.

For the next several sessions, things went in a very similar manner to the fourth session just described. The students brought their sheets with them and each student worked on his/her own computer. The students seemed to be finding the keys easier and I enquired of Christine as to the reason.

CHRISTINE: We've been practising in the classroom. I took a picture of the Apple II E keyboard and enlarged it. Then I blacked out the letters that the students seldom used. We play a kind of Bingo with this keyboard using a deck of cards with letters and

numbers on them. When I call a letter or number, the students cover that letter on the keyboard and they also have to tell what that key will make the turtle draw.

Christine and her aides went from student to student. They asked them what they wanted to draw, if they seemed stuck. Some of the students would just point instead of answering.

CHRISTINE: Is it a triangle that you want to draw? What letter do you need to press? Can you find the T on the keyboard? [To another student] That's really good. You've drawn a big triangle. What else do you want to draw in your picture. [To another student] Good boy. That's a house that you've drawn. What else do you want in your picture?

Session No. 5 -- May 1

When I arrived for the May 1st session, we found that a junior high class had booked the computer lab, so I dropped into Christine's class to talk with her about Logo and her class.

RESEARCHER: There's a couple of things I've been wondering about and would very much appreciate your insights on them, if you've got some time.

CHRISTINE: Sure. What would you like to know?

RESEARCHER: When we first presented the inservice on Logo, you were really enthused and interested in working with it with your students. Could you tell me what it was that caused that interest? And one other thing -- I would appreciate if you could shed some

light on why you never seem to be concerned about the time it takes out of your day to do the Logo classes.

CHRISTINE: Well, although the TMH classes do have a curriculum, it's a very flexible one in that there's not a set number of minutes that certain things have to be done. There's a greater degree of freedom in what and when we do things. Having this flexible timetable was one reason I wanted to try Logo, but the other reason is that Carol [the other TMH teacher] and I had attended this inservice a while ago and they showed us several programs that were being used with handicapped students. There were some really neat things that the students were doing. So when you came along with this Logo, it seemed a good chance for both the students and me to become familiar with computers and learn how to use them. Working with computers is such a normalizing activity for our students.

Session No. 6 -- May 3

At the beginning of the sixth session, after the students were at their computers.

CHRISTINE: Today, I would like you to think about what you want to draw before you do it. Plan it out in your head before you make it. Think about how you can use the shapes to draw something -- could you use a square and a triangle to draw a house of your own? Can you use the shapes that you know to draw a picture? [To the aides] Encourage the students to think about what they want to

draw. Try to get them to use several shapes to make a picture instead of just hitting any key to do the shapes.

The students worked on the computers using their shape sheet. Christine and the aides worked with the students, encouraging them to draw pictures instead of just shapes. To this observer, the pictures they drew didn't seem to have any more organization than they had on previous occasions.

Session No. 8 -- May 17

When the students came in for their eighth session, one of the students had forgotten his sheet with the letters and shapes on it.

CHRISTINE: Well, Michael, since you don't have your sheet, you can either go back and get it or you can try to remember what was on it and do the best you can.

Michael decided that he would try to do it without his sheet. He seemed to remember what the different commands were as he appeared to be pushing specific keys rather than just any key. Some of the other students saw that he was working without his sheet and decided that they would do without their sheets as well. Christine and the aides circulated among the students.

CHRISTINE: [To student, after he had drawn a circle on his screen.] What does that look like? What do you see every day that looks like that? [No answer.] What do you see outside that looks like that? Try to use the shape and make it part of a picture.

After Christine left, the student sat for a while and looked at the circle and then proceeded to draw several other shapes on top of each other.

Christine asked if I wanted the students to experiment with any other programs other than Logo. She said that she had a Sesame Street disc that she thought the students would really like.

CHRISTINE: I think the students are beginning to get bored with what they're doing, but I don't think that they can use regular Logo. What I see as being the next step is for them to draw something recognizable, but I'm not sure when to stop giving aid in order that the picture will be theirs and not mine. They don't seem to be getting the idea of a picture but I keep feeling that if I give any more help, then I'm imposing my ideas on them. It would help if I knew more of the scope of Logo and what it can do. Then, maybe I could do more with it.

The students continued to draw pictures of their own design, made up of the various shapes. Christine and the aides continued to ask them what they wanted to draw, what keys to push and where the keys were located. They encouraged the students to try things on their own. The pictures at the end of each session were saved under the students' names and run off on the printer. The students seemed to really enjoy having the printed pictures.

Session No. 9 -- May 24

Today, one of the students created a regular pattern on his monitor by repeating two commands. He got very excited and called

a couple of the other students over to see it. They seemed to really like the pattern, but didn't ask how he did it, nor did they try it when they returned to their own computers. A couple of other students did create different patterns and everyone rushed over to see what was on their monitors. Christine and the aides continued to follow the pattern of asking the students what they wished to do, how they would do it and where the keys are located that will make the turtle do what they wanted. They often made comments such as "That's really neat.", or "That's really nice." or "That's a nice picture. What can you add to it?"

The last two sessions were very similar in nature to the previous ones. The students seemed to be getting restless and not interested in drawing pictures. Christine brought in the Sesame Street disc for these last two sessions and let some of the students work on it. It had bright graphics and the students got excited, naming the characters that they recognized and worked on the different parts of the program.

Christine also used the REPEAT command in order to show the students motion geometry. They grew very excited as the turtle repeated the various shapes to form patterns. Christine made the comment that it was nice to just be able to have the students entertained for a change.

At the conclusion of the last session, Christine and I talked about her feelings about the work she and her students had done with Logo.

CHRISTINE: It's been a positive experience. My intent was to introduce the students to the computers. I've seen articles on using

computers in special education and I've felt guilty that I've never tried them. The articles said that computers would open up new areas for the handicapped students and help them to overcome handicaps in other areas. I wanted to see if our students could really use computers. If they could, it would be such a normalizing activity for them. They see regular junior high students working with computers and if they could do it too, it would make them feel like everyone else. I've learned a lot about computers through using Logo, and so have the students. Now that they can use the computers, they will be able to use other software programs.

RESEARCHER: If you teach Logo next year with your students, will you teach it the same way?

CHRISTINE: Yes, I think I would. The students did make a lot of gains. They learned that what they did affected the computer. Some gains they made accidentally, but nevertheless, they were real gains. We used Logo to emphasize what they had learned in the classroom and what we learned in the classroom reinforced what was being done in Logo. It's all interwoven. At the time I did it, I wasn't conscious of trying to reinforce each area, but it's basic to teaching these students.

RESEARCHER: Did you teach Logo any differently than you teach your other subjects, except, of course, you were working on computers?

CHRISTINE: I gave the students a lot more freedom than I usually do. Because I wasn't able to get around to all of them in the computer lab, they had more freedom than in the classroom. They were able to do a lot more on their own and got feedback from the

computer. In the classroom I work with small groups and I'm right on top of their every move and am able to give them instant feedback. The computers really are made for special education because the students can do what they can do at whatever rate they can operate. For Logo, and in most of my other classes, I really didn't have an end goal in mind. We progress from day to day. We try to get the students to concentrate and focus on the activity at hand. And Logo has been good for this.

CASE STUDY NUMBER THREE -- CAROL

Introductory Session - March 15

The first session with Carol occurred under very similar circumstances to Christine's first session. Having not received any commitment to participate in this Logo research project from Carol, I was uncertain if she and her class intended to work on Logo. After arriving at the school, I had checked with Christine to see if she intended to participate and had received an affirmative answer, also that she would be up to the lab in five minutes. Going on directly to Carol's room, I asked her if she desired to participate and work with her students on Logo.

CAROL: Sure. I'd planned on it. We'll come up right now.

I indicated that Christine was going to be using the lab right away, but could she come up when they were finished. She said that would be no problem and that I should come and get her when the lab was available. I asked her if she wanted to work with the

regular Logo program or if she wanted to use Instant Logo. She said that she thought that we had best try Instant to start with.

Later, the 9 TMH students came hurrying up the staircase and into the computer lab. The computers all had Instant Logo on them, having been left that way by Christine's class.

CAROL: What do you want me to do? Is there any special place you want the students to sit?

RESEARCHER: What you do is entirely up to you. The computers have been booted up with Instant Logo and are ready for you to use. The regular Logo is also in the computer, so you can use either or both. It's your class. You conduct it however you desire.

CAROL: I think I'll demonstrate some of the things first. Would all of you students please come over to this computer? [The aide and the student teacher collected the students, who by this time were sitting at various computers, and brought them over to the computer where Carol was.] We're going to be working on the computers. Do you see this triangle on the screen? This is called a turtle. And by giving it commands, we can make it move and draw things. It can go Forward, Backward, Right, Left and and can draw different shapes. What do you want the turtle to do?

STUDENT: Move.

CAROL: All right. Let's make him move Forward. What sound does Forward begin with?

STUDENT: FF.

CAROL: That's right. Can you find the F key on the computer? [One student does.] That's right. In order to tell the turtle what to do, we have to press the key. Dale, you can press the F key.

[Nothing happens.] Oh, yes. After pushing the key to tell the turtle what to do, we have to push this key that says RETURN.
[Carol pushed RETURN.]

The majority of the students made some sort of noise and pointed to the screen when the turtle moved forward.

CAROL: We can also make the turtle turn different directions. He can go Left or Right. What direction should we make him go?

STUDENT: Forward.

CAROL: We can make him go Forward, but let's make him turn first. He can go Left or Right. What direction should we make him go?

STUDENT: Right.

CAROL: All right. What sound does Right start with? [Student answers correctly.] That's correct. Can you find the R key? [Students crowd around and one of them points to the key.] Jimmy, push the R key and then remember to push the RETURN key. Do you see how the turtle has turned? Now, we can make him go Forward again. How will we make him go Forward.

Following this pattern of questioning and directing, Carol demonstrated Left and Backward to the students. She then sent the students in selected pairs to work at the computers. Two students were working singularly at computers.

Carol, the aide and the student teacher went around to the students and asked them what they wanted the turtle to draw, what sound the selected command started with, and where that key was located. They worked for about another ten minutes and then returned to their classroom.

There were two aides with Carol's class, but usually only one came with the class and other stayed in their classroom. Often one or more students would also stay in the classroom to do various activities.

When the students arrived for their second session of Logo, they were sent in pairs to sit at the computers. Carol selected the students that were to work together and the computers they were to work at.

CAROL: Last time we worked at the computers we found that we could make the turtle move Forward and Backward and we could make him turn different directions. The turtle can also draw big and little circles, big and little squares, and triangles and houses, trees, mountains and a sun. Today, we'll work on having the turtle do some of these things.

Carol, the aide and the student teacher went around to the students.

CAROL: What do you want to draw, David? [No response.] Do you want to make a square? [Student nods.] What sound does Square start with? [No response.] Does it start with SSSS? [Student nods.] Can you find the S key on the computer? [Student seems unable to.] Is the S key on this row of keys? [Student still seems unable to find it. Carol points to the S key.] Is this the S key? [Student nods.] Push the S key and then push the RETURN Key to get the turtle to draw a square. [Student does so.] Now, you see if you can make the turtle to draw something.

The students had trouble in pushing the key so that it would register just one letter, as they usually held the key down and got numerous repetitions of the same key. Carol and the aides showed the students that they had to push the key and then quickly remove their fingers.

CAROL: [To another student.] You've drawn quite a few things in your picture. Do you like it the way it is, or do you want to add some more to it? [Student doesn't seem to know what to respond and says nothing.] Shall we save your picture this way or do you want to add something else? [Student pushes another key and Carol leaves him to work on his picture.]

Similar questions are asked of the students until it is close to the end of the period.

CAROL: We're going to save your pictures and run a copy off on the printer. What do you want to call your picture? [Student doesn't answer.] Do you want to call it your name? [Student answers, yes, and Carol types in his name for him.]

Each student's picture was run off on the printer and given to the student. They seemed very pleased and excited to get their pictures. During the lab session, the students talked [those who could talk] with one another and wandered around seeing what others were doing.

Session No. 3 -- May 3

Due to my attending a conference I was not back at the school for two weeks. When the students arrived for my third session, they had with them the sheets that Christine's class were using, with the letter commands and the shapes that each command would draw. [See Appendix D for complete sheet.] The students went to the computers and started to work, using the sheets for reference. Carol told me that she had taken the students up the lab a couple of times since I was there last and had worked through the sheets with them, going over each key to see what it would draw.

CAROL: Use your sheet to practice following directions. Use the keys your sheet tells you to, and don't put in things that your computer can't do. When you have practised these and are able to follow directions and use what is on the sheets, then we will go on to more difficult things. [To one student.] You've got a lot more room on your screen. Put some more things in your picture. Why don't you move your turtle over here before you draw anything else, so that you won't draw everything on top of each other. Use the F key to move your turtle Forward. [Carol moves the turtle Forward.] Now, what do you want to draw in this space?

One of the students is autistic. Some of the times he has come to the lab and other times he remains in their classroom. When he comes to the lab, one of the aides sits with him at the computer. She would enter the command into the computer. When the turtle

drew a shape, she would tell this student what the shape was. She would then ask him what the shape was. If there was no response, she would then ask, is that shape a circle?

The students go back and forth to the different computers. Sometimes they just seemed to look and other times they seem to be working together to draw the shapes. Carol had colored the shapes on the sheets that the students were using because, as she said, otherwise the students weren't about to distinguish between the letter command and the shapes to be drawn.

CAROL: [To Researcher] I think Joey is almost ready to go on a regular Logo. Next time, we'll let him try it and I'll just add any other information he needs to his sheet. Some of the students' pictures seem to be improving -- they aren't drawing all the pictures in the HOME position. Some of them are starting to move the turtle to different places before they draw the shapes.

Each week the pictures were saved on disc and run off on the printer. Carol indicated that she was going to have a scribbler for each student and put all of their pictures in it so that they could see the progress they were making.

For the next several sessions, the students arrived with their sheets and went directly to their computers [they always worked at the same computer] and worked on their own, using the sheets for

reference. When the students seemed stuck or weren't doing anything then Carol or the aide assisted them in this manner.

CAROL: What do you want to draw now? Look at your sheet and see what shape you want to draw. [To another student.] Why don't you move your turtle to another place before you draw anything else? [To another student.] Your screen isn't filled up -- do some more. [To another student.] There's lots of room on your screen. Put some more things on it.

A couple of times only part of the students were in the lab and the rest were working on projects in the classroom. As the students finished what they were working on in the classroom, they would come up to the lab and others would go down to the classroom. On these occasions, Carol would be the only adult present in the lab as the aides would be working in the classroom.

During one of these sessions, Lyle created a pattern in his picture by the repeated use of the H command. Several students rushed over to his computer because of the noise and comments he made about his picture. They seemed to really like his picture and they rushed back to their computers to try to do the same thing. They didn't ask him how he did it and he didn't tell them.

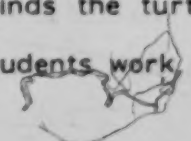
Joey is using regular Logo and although he doesn't have much success in drawing shapes, he does use the FD command, entering numbers in after it, and the RT command, entering numbers in after

it, and is very successful in drawing lines all over his screen. He seems to be enjoying what he is doing and works steadily without looking up from his screen.

The sessions continued in like manner until the middle of June, when the research project terminated. The students worked at the computers with their sheets, drawing whatever they wanted to. Some are still drawing all the shapes at one spot and others are moving the turtle around before drawing a shape.

CAROL: That looks pretty good. What else could you put in it? Fill up your screen with more things. [To another student.] You still have a lot of room left on your screen. Put some more things in it. [To another student.] That's a good picture, but you still have a lot of empty space on your screen. Put some more things in your picture. [To another student.] Is your picture finished? Are you ready to save it? What do you want to call your picture? [To Vince.] Vince, that is really a neat picture you have on your screen. [It is a pattern drawn by repeating the H command.] Where did you learn to do that? [Vince points to Lyle, who had discovered the pattern a couple of weeks ago and had done it several times since.] Lyle, did you show Vince how to do this picture? [Lyle nods.] That's really a nice picture, isn't it?

Carol goes around to the students and encourages them to draw something else, or fill up the screen, or she finds the turtle for them if they have run him off the screen. The students work pretty



well on their own, doing whatever they desire. Sometimes Carol is the only one present. Sometimes the aides are present and sometimes a junior high student comes in to help Carol with her students. Carol kids around a lot with the students about erasing their pictures instead of saving them and the students laugh and giggle at her jokes. The atmosphere seems relaxed and pleasant but any fooling around by the students is quickly stopped by Carol or by the aides. The students are expected to work at their computers and the majority of the time they do so for the full lab period, which varies from 45 minutes to an hour. Their pictures were run off on the printer for the students at the end of each session.

Session No. 7 -- June 7

After the last session, Carol and I talked about her experiences using Logo with her class.

RESEARCHER: How do you feel about the experiences you've had while using Logo with your class?

CAROL: It was good introduction to computers for both the students and for me. I wanted them to learn how to operate the computer, which they did while they were using Logo and now they are able to go on past Logo. The students did learn to hit just the keys that were used for Logo and not just any key and they learned to do a lot on their own. My main goal in teaching the special education students is to develop independence. I learned this when I

was teaching the older students. I've always been in Special Education. The first three years, I taught the older students in the living vocational areas. Then, for a change, I switched to the elementary students and this is my third year with the younger students. Some of the students I have now, I've had for all three of those years. The main thing with these students is to try to get them to do things on their own. Normally we work with small groups in the classroom, but even in these groups we're always trying to get the students to try things on their own.

RESEARCHER: Except for the fact that you were working on computers, did you teach Logo in a similar manner to the way you usually teach in the classroom?

CAROL: Pretty well. The students that needed more help, I put in one area, and those that were more independent, I put together. I grouped them at the computers in small groups or one at a computer, depending on the amount of help I thought they would need. Basically, I used the same approach as I do in all of my classes. The students were more interested in the computers than in some of the other things that they do, so that made some difference. I used Logo to reinforce the language aspect for those who could read and who could learn and recognize sounds. If there had been more time, I would have had them do some harder things -- like having a design in mind first and then creating it, or maybe trying to copy a picture. There just wasn't enough time. One thing that might have helped is if we had more of an introduction to the

computer before we started on Logo. I needed to know more about the mechanical aspects of the computers -- how to operate them and maybe fix them when something went wrong. Generally, though, it was a good experience. The students gained what I wanted them to and parents were happy about their children learning how to operate a computer.

CASE STUDY NUMBER FOUR -- SUSAN

Susan taught a grade six class, the majority of the time, but for one period a week she was working with six students from a grade three class. These students Susan referred to as above average achievers. It was with these six students that Susan worked with Logo.

At the first meeting with the principal and the selected staff, Susan had indicated that she was interested in Logo, but that there was no way that she would be able to participate in the research project because she had a very full timetable and there was not any time available to include another subject. At that time she was teaching computer literacy to the students of grades four, five and six, as well as the regular subjects to her grade six class.

SUSAN: I am interested in learning Logo because I can see where I might be able to use it next year with grades five and six. Since I've already taught them the computer literacy program this year, I'm concerned about what I'm going to do with them next year. But I

just don't know where I can find the time to do it [the Logo]. As it is, I have to steal time from science to do the literacy program. But I do have a group of grade three students that I might be able to use their period to do Logo. However, I can't do it on a Friday because I don't have the students then and I wouldn't be ready to start until after Easter. I need some time to work through some of the Logo for myself first. Mr. B. [the principal] gave me this book on Logo. I'm going to try to work through it and I might just use it for the students and work through it page by page.

RESEARCHER: There's no problem with your having your class on Thursday -- I can be here at that time if that's the best for you. And as for starting after Easter, that's fine with me.

Introductory Session -- April 4

The first week in April, Susan and her six students arrived in the computer lab. The students all quickly found themselves computers -- all of which had been booted up previously by Susan, with Terrapin Logo.

SUSAN: Before we begin, let's review a few things about the computers. What is at the bottom of the screen?

STUDENT: The cursor.

SUSAN: What does the blinking light tell you?

STUDENT: That you need to put something into the computer.

SUSAN: What does the shape in the middle of the screen look like?

STUDENT: A triangle.

SUSAN: Yes, it does. But that is what we call a turtle. I'm going to give you some very simple commands. Once you have the commands, I am going to let you draw your own designs using these commands. The first thing I want you to do is type in FD and then leave a space. Then you need to tell the turtle how far to move. Type in 50 after your FD and see what happens. Remember, you need to press RETURN after you have finished with your instructions. [Students do so.] Another command you can give the turtle is Backward. Type in BK, a space and then 50. What happened? [Students answered.] Now you know how to make the turtle move Forward and Backward. We can also make him turn Left and Right. Type in LT for Left and then a space. Watch his head carefully because it's rather hard sometimes to see what way he's turning. Type in 60 after Left, but watch your screen when you push the RETURN key so that you can see him turning. [Students do so.] Now, type in RT, space and 50. Watch your screen when you push RETURN so that you can see how he is turning.

I'm going to give you one short exercise to type in and then I'm going to see if you can draw a simple picture using these four commands. Type in FD 75, RT 90, BK 60, LT 70 and see what happens. [Students do so.] All right, now I want you to use these four commands to draw a simple picture.

Students worked with the four commands and started drawing various designs or pictures. Susan walked around among the students.

SUSAN: What did you want to draw? [To another student.] Do you have a picture in mind? [To another student.] Do you want to go Forward or Backward? [To yet another student.] You've got quite a picture there. Can you tell me about it? After you work with this you'll know how far a number will take the turtle.

Some students drew squares or specific shapes while others just created designs.

SUSAN: Next time up here, I will give specific tasks using these commands you have just learned. Today, you did whatever you wanted. Next time, I may have you draw a square, or perhaps we'll try your initials. You may want to jot down these four commands when you get back to your class since you won't be back here for a week. Before we go, what two commands cause the turtle to draw lines? [Students answered.] What two commands cause the turtle to turn? How do we clear the screen? [Students answered correctly.] Clear your screens and you can return to your classroom.

After this first class, Susan talked to me about the pressures of trying to cover the curriculum and yet find time for Logo and computer literacy. She said that in order to find time for the computer literacy, she had to steal time from science, and in order

to do Logo, she had to steal time from computer literacy. She really didn't feel good about doing this because she needed the science time to do science.

Before the group of students came in for their second session with Logo, Susan came to me to discuss what she planned on doing that day.

SUSAN: Today, I'm going to review the commands we covered last day and then I'm going to give them specific shapes to draw and then I'm going to see if they can draw their initials. Or do you think I should do it the other way round -- do the initials first and the shapes last?

After discussing the idea, we decided that the drawing of the shapes would help the students to figure out how to draw their initials, and therefore her original idea was best.

SUSAN: [To students] Today, I am going to have you draw some specific things. First, I want you to draw a square. Use the commands that we learned last week and make me a square with 50 steps on each side.

There was a Logo chart on the wall of the lab showing the FD, RT, LT, BK, CS, HOME commands and a circle chart showing the turtle turns of 90 degrees, 45 degrees, 180 degrees and 135 degrees. The students went to the chart to check out commands and

they also went to each other to see what they were drawing. Susan went around to the students to ask them what they wanted to do, or else to tell them what they need to do, depending on what help the student needed.

SUSAN: You want to go Forward 50, but do you want to turn 50 degrees?

STUDENT: No, I guess I don't. Is 90 what I need?

SUSAN: Remember that RT and LT only change the direction of the turtle and in order to get him to move, you have to use FD and BK. [To student.] If the turtle turns right, where is he going to go? Put yourself in the place of the turtle. What will he do? [Susan physically took the student and turned her left and right so that she could see what direction the turtle would turn.]

Some of the students drew one square while others drew several. Some drew the squares so that they formed crosses while others put them in rows or made other designs with the squares. Only a couple of them started on their initials.

SUSAN: [To one student.] What can you do with more than one square? Can you put squares in several places on your screen? [To all the students.] For next week, I want you to think about your initials and how you would go about drawing them. You'll have to square off the letters so that you'll be drawing straight lines. In

your head, figure out how you would draw the letters. Do some mental practice before next session.

After class, Susan talked with me for a short time about what the students had done and how they had taken longer than expected.

SUSAN: Even though the students didn't get done all what I thought they would, they were still learning so I suppose it doesn't matter how much they got completed. They would have got more done if there was less talking among them. But even then, I'm sure they were learning.

Susan again talked about the problems she was encountering with time restraints -- in this case, her concern was that she just didn't have the time on her own, outside of class, to go through the Logo materials.

Session No. 2 -- April 1

During the next class period, the students worked on drawing their initials. Some of them had them drawn out on paper. They went back and forth to look at what others were doing. Sometimes they would ask questions of each other or make comments about what was being done. Susan helped them by asking what they wanted to do, or needed to do. And other times she suggested numbers that they might try to get the turtle to where they wanted it to be. A

couple of times, the students would stand up and turn left or right and walk and then turn another direction and then would go back to the computer and work on their initials. One student completed his initials.

SUSAN: That's really good. Can you think of a short word of two or three letters that you could try to write now? Before you erase it, everyone come and take a look.

SUSAN: [At end of period.] Grade three, we'll probably spend more time on this next week. Do some mental practice as to how you are going to do your initials. Those of you who finished their initials this week, we'll give you something more challenging to do next week. Turn your computers off, but not the power bars as the grade sevens are coming in now.

Susan stayed after class to talk with me about the class and her concerns. She talked about the pressures the curriculum placed on her -- the feeling that she had to finish the curriculum because of the exams the students had to take in the various subject areas. She stated that she had to pretty well stick to the curriculum because of the objectives handed in to the principal and the fact that the principal was pretty well up on where people were in their curriculums. Another factor that made time even more of a concern was the fact that religion was also scheduled in, and time for it had to be taken from some place. As far as Logo went, she stated, "because there are no pressures to finish or outlines to follow, I'm

going to let those students who didn't finish their initials, finish them. And the others can go on to other things." Susan expressed that she was feeling like she was in a pressure cooker.

There were no classes for the next two weeks -- one week due to another commitment on my part, and one week due to Susan's busy schedule. And also, Pat [the students' regular teacher] was reluctant to let the students go to Logo because they had been misbehaving.

Session No. 3 -- May 9

The students arrived at the lab.

SUSAN: All right. Those who didn't finish their initials last time, please do so today. Those who are finished, I want you to experiment with different size angles to see what happens. You can use any angle you want to, but you are not to draw a square. Remember that you can use the PU and PD command in drawing your shapes. Drawing these shapes is all very logical. You just have to go step by step.

STUDENT: How do I make a M?

SUSAN: That's a hard one. You'll have to make the angle something different from 90 degrees. Try 45 and see what happens. [Student does so.] That wasn't enough, was it? Play around with other

numbers and see if it turns the amount you want. Experiment with different numbers. [To a different student.] Are you beginning to see where the different angles take you? Have you seen Andrew's picture? Take a look at it and see what he has done. [To another student.] What are you trying to draw?

STUDENT: A bow tie.

SUSAN: You need to figure out what direction you want to turn and how much you need to turn. [To another student.] Don't worry about size relationships today. If it doesn't turn out the way you want it to, we'll call it a shed or something, instead of the house you were planning on. [To another student.] I want you to work on drawing an oval. Try something a bit more rounded. Make it a good size. [To the whole group.] Next week, I want you each to come with a picture on a good sized piece of paper. This picture must have three objects in it and none of them can be a square. In your head, try to figure out how you would draw this objects. It could be a face with eyes, nose and mouth. I want you to come with three objects in mind -- actually drawn out on the paper.

After the students left, Susan stayed to talk.

SUSAN: I want the students to draw the picture out beforehand so that they won't waste time in class trying to figure out what they want to do. Today, you saw what the students could do when they

concentrated. I've been working on the 'ants-in-the-pants' students, trying to get them to settle down and work on their own.

The next session started off with the students running up the stairs with sheets of paper in their hands and quickly going to a computer.

SUSAN: Some of you have some pretty challenging figures. That's all right. Just work on part of your figure if it's a complicated one. If you have three figures, work on one at a time. If you don't get to all of them, it's all right.

The students went to work trying to draw the figures they had on their sheets. Several of them were trying to draw curved lines. Susan worked with one student on drawing a circle or a curve and they talked about going Forward a little way and then turning a little way. Susan went around to each student and helped him/her figure out what they wanted to do in order to get the turtle to draw what they wanted. Every so often a student would stand up and turn one direction or another and then go back to working on the keyboard. The students were trying different things to see what would happen. And if that wasn't what they wanted, then they tried something else.

SUSAN: [To one student.] I can see from what you've done that you're trying to do what you drew on the sheet. Some things just take practice to get them to do what you want. [To student who has

had problems in drawing what he wanted.] Now that we're off track, let's see what we can make out of what you've got. If it doesn't turn out the way you want, use what you've got and create something else. [To the whole group.] Next week, come with your diagram done on a piece of paper. Pick one shape to draw. When you arrive next week, have the shape drawn out and also see if you can write out what you will do in order to draw that shape. Plan it out and think about it. You can use any shape except a square or a rectangle. Try a different shape next week from the one you did this week. Remember, plan it out and write it down so that you'll be prepared to go to work.

Session No. 5 -- May 23

This session was very similar to the previous one in that the students arrived with the desired shapes drawn out and also an attempt to write out the steps that would result in that shape. They worked individually on their shapes trying different numbers for angles and sides to see if it did what they thought, or wanted it to do. If not, they tried something else. Susan went from student to student to ask questions, or give suggestions. She sometimes typed in things to show them something or instructed them to type in something to experiment and see what happened. At the end of the session they were asked to plan and write out what they planned on doing and how they would do it, for the next day. They were required to use two different shapes touching each other for the next session.

Session No. 7 -- June 7

During the last Logo session, the students were working on the two-figure design. They worked independently but often went to look for or talk to another student. One girl had been working on a computer at home with her brother and had found out how to use the REPEAT command. She excitedly showed others how to draw circles and other patterns.

Susan went around to each student, encouraging them to think about what they were doing. She asked them what was going to happen if they did a certain thing, or asked them how they would get the computer to do a certain thing, or go in a certain direction. She encouraged them to take their time and be careful in what they were doing. Even though the one student had found out how to draw a circle using the REPEAT command, there were still two students working on drawing a circle by typing in the commands one at a time, which takes a long time. But they seemed content to do it this way and they eventually ended up with a circle, over which they seemed very pleased. When Susan announced that this was their last session, the students seemed very disappointed.

After the last session, Susan and I talked about her experiences in working with Logo.

RESEARCHER: Susan, how do you feel about your experiences in working with Logo?

SUSAN: More positive than when I started. I didn't take myself nor the students as far as they could go because of limited time. Now I've got the background to utilize it next year. But I'll definitely have to do more work on it. It wasn't as frightening as I thought it was at first. I think the students gained in terms of being able to explore their imaginations and being able to experiment. I'm still having trouble myself, because of the heavy, heavy commitments to curriculum, seeing where, other than a specific computer class, that I could allow class time to do it [Logo]. For geometry, I could see it fitting there, but at a grade six level they are doing geometry with the instruments and they can do it in a lot less time and I have to be concerned about the time. I know that the students would prefer the computers. If they knew they could do it on the computers, I would probably have a miserable time in the classroom trying to convince them that they should use the instruments. But in terms of time, it's touch and go as to whether you finish a course now. So for myself, it would be more of an extra -- an option and that's how I see myself using it. But unless they cut out a few of the subjects now that the government is saying that we do, then I just can't see it. Right now, even our computer literacy program has no room for it in the curriculum. Next year, it will be something else that will have to fit in, plus the extras. Community-wise, they [the school] are always doing something. So you're always under a time pressure. So to be quite honest, that's how I see it for the future.

I've heard that in the public system, the grade six students don't have to write all the exams. But they do here. There seems to

be a real move towards these exams, and if so, it goes back to the days when teachers taught to those exams. It's back to the accountability thing. So, gone are the extras. Although I hate to say it, some of the things the students enjoy the most are the extras. Time wasn't a problem for me this year because I had been allotted that computer period. But for next year, it will be.

RESEARCHER: Can you give any other negative aspects of teaching Logo except the one you mentioned, of trying to find time to fit it into your curriculum?

SUSAN: No. Except I think it would be difficult for students who have trouble conceptualizing. Even for the students I had -- and they were the bright ones -- it took several lessons to get Right and Left straightened out. I think for some students who have trouble conceptualizing, that there would be a real problem and it could be frustrating.

RESEARCHER: Were there any positive aspects of teaching Logo?

SUSAN: Well, experimentation and beginning to use their imagination. Because of the students they were, I tried to point them in that direction. I gave them an idea and let them go from there. Some of them handled it better than others. Of the six students, three of them were able to really take off.

RESEARCHER: Would you have taught it differently if I hadn't been in your classroom?

SUSAN: No, I don't think so. I'm not crazy about being monitored. I can go in the classroom and talk to my students from nine to three and there's no problem. But as soon as someone walks in, it's different. I might have been a little more relaxed if you weren't here, that's all. I feel quite relaxed with my students. Mr. B. [the principal] walks in all the time, but it wouldn't matter if it was my mother. It's different having someone there. But I would have done it the same.

RESEARCHER: Did you teach Logo much differently -- did you use a different method or approach than you normally do when you teach? Did Logo cause you to do it [teaching] in this particular way, or is this the way you usually teach students?

SUSAN: No, I do it normally. That type of exercise I would probably do that way. When there was a division of ability, then they each worked on what they were doing and finished number one before going on to number two. In terms of strategy, I don't think I did it differently than in any other subject. But there's not a lot of subjects that you have time to explore in. You know that you just have to stick to what's there -- "Sorry, kid, you can't have any more problems, we have to go on to the next page."

RESEARCHER: Do you think you explored more because you weren't certain of Logo either?

SUSAN: That's possible. I was working through it at my rate and at their rate. I had no end goal in sight -- just explore with them as much as possible in the few weeks we had, and that was nice because there was no time pressure that way.

RESEARCHER: Did it bother you, not having an end goal?

SUSAN: It could have, but I decided not to let it because I had too many things I had end goals for. I thought, when they're ready for the next step, we'll go on to the next step. Because of the other subjects always having that pressure, maybe I had it at the back of my mind that I should be having these students go faster. But they were enjoying what they were doing. They hadn't finished exploring what they were doing and I hadn't gathered from you that there was an end goal, so I just let them work at their own rate.

The computer literacy program was good, but it was pressure again because we had to be right on schedule for the consultant who came out once a week. Maybe, if right in the schedule there would have been so many periods for computers, I wouldn't have felt the pressure, but I was stealing time to try to get everything done for him [the consultant]. I just feel that if you don't have room for it in the timetable, then you shouldn't be doing it. However, it was great and the students loved it. But there was still the time pressure to find time to do it. You had to steal time from somewhere.

CHAPTER FIVE

INTERPRETATIONS AND CONCLUSIONS

INTERPRETATIONS

ASPECT (A):

WHAT PEDAGOGICAL STANCES ARE INHERENT
IN THE NATURE OF THE CLASSROOM CONTEXT
THAT TEACHERS CONSTRUCT FOR LOGO?

The broad, and guiding research question under consideration in this study is: What Logo interpretations are made by the teachers and how are these implemented? The following data deals with this question and also specifically with ASPECT (A) of the research question -- What pedagogical stances are inherent in the nature of the classroom context that teachers construct for Logo? Because of the complexity of the social situation, in this case, the Logo subculture as it developed during the implementation of Logo within four different classrooms, various influences affected these Logo interpretations and implementations. These interpretations and implementations in turn determined the classroom context that the teachers constructed for Logo. The following four areas of influence

are deemed to be relevant and important to all of the teachers involved in the interpretation and implementation process.

I. PEDAGOGICAL AND PHILOSOPHICAL BACKGROUND OF TEACHERS PARTICIPATING IN STUDY

The classroom atmosphere, the activities carried out there, and the methodologies and strategies used within the Logo classroom are due, in part, to the influence of what the teachers brought to that situation. The first area then to be considered is the pedagogical and philosophical background of each of the teachers. The following information was given by the teachers in response to the request, given in a taped interview with the researcher at the conclusion of the study (see Appendix C for Interview Questions), to share any personal background information that they felt was relevant to, and that influenced the ways in which they chose to implement Logo.

(1) RAYLENE

Raylene didn't feel that there was anything in her teaching or personal background that influenced either her decision to participate in this study or the manner in which she implemented Logo. She was anxious to learn about computers for her own sake because she thought computers were something that was here to stay, and something that her students were going to have to know about. It was important to her that the students be introduced to computers in the lower grades in order that computers wouldn't seem foreign, frightening or complicated when they worked with them in

the upper grades. Although she felt that it was necessary that the students cover the core subjects, she had no problems in justifying to herself, the taking of time from these subjects to work on the computers.

(2) CHRISTINE and

(3) CAROL

Special education was the area in which both Christine and Carol had worked for their entire teaching careers. Christine had worked with dependent handicapped children before working for four years with the trainable mentally handicapped students. Carol had always worked with the TMH students -- three years with the older TMH and three years with the younger ones. She had switched to the younger students because she felt that she needed a change. She had entered the area of special education and remained there because she liked working with these students. Her main goal in teaching them was to develop their independence.

(4) SUSAN

Susan, a grade six teacher of six years, was trained as a physical education teacher with a geography minor. The first four years of her teaching were at the junior high level. During the first two years she was required to teach "everything under the sun, so I learned to be adaptable at teaching things I wasn't qualified to teach. In physical education there is a lot of exploration. You give the students a skill and they go from there." (Susan 1985) From the junior high level she moved to an elementary-junior high school

where she taught grade six. The principal requested that Susan teach the computer literacy course at her school. She had expressed no previous interest in computers nor in teaching such a course. Previous to the time of being asked to teach computer literacy, she had taken an eight-week basic course in computers and had found it a great deal of work and frustration. Because of the work involved in this course, she was not at all sure that it was worth the effort required. Susan felt that perhaps she might have been selected to teach the computer literacy course because of this computer course, or perhaps it might have been because her principal thought she was flexible enough to try it.

Susan expressed the opinion that she felt that she was a teacher who liked to encourage exploration and use of the imagination in her students regardless of the subject or curriculum area being taught. She also felt that individual differences and rates of learning were factors that should be taken into consideration in teaching even though time and curriculum pressures did not always allow proper consideration of these factors.

II. CONCERNS OF TEACHERS REGARDING LOGO IMPLEMENTATION PRIOR TO INTRODUCTORY SESSION WITH STUDENTS

An area shared in common by the participants of this study is the concerns they had regarding Logo implementation prior to their introducing it to, and working on it with, their students. Because of

the concerns of some teachers, they opted out of participating in the study. These concerns are relevant to the methodologies and strategies used, in that if one has grave concerns or reservations about a project, the ways one approaches and participates in the project cannot help but be affected.

Although only four teachers participated in this study, the project was discussed and introduced to several other teachers in schools other than the one involved in the research. Even though these teachers were not the principal nor the continuing participants in the study their concerns are relevant to the research. By noting the questions raised and the concerns expressed by this group of teachers, a broader and more complete picture may be gained of what is involved in introducing a new curriculum or subject into a classroom setting, and may shed some light on the reasons why some teachers are willing to implement new curriculum while others are not.

A concern that was expressed several times by teachers who, in the end, did not take part in the study, was not having the time to add something else into their already full curriculum and days. The interest in Logo was there, but when it came down to the practical implementation, the interest dissolved because there was neither the time to implement the program with the students, nor the time for the teachers themselves to become familiar with the new curriculum. The phrase "How can I teach this, when I don't know anything about it?" was one that was expressed by more than one teacher.

The reluctance to having an outside observer in the classroom when the teacher did not feel competent in the methodology or material she/he was teaching was evident with many teachers -- both in those who participated in the study, and to a greater extent in those who eventually dropped out of the research.

Another trouble area for the teachers, both in and out of the study, was the fact of there being no written curriculum, no prescribed books, no outlined goals or objectives and no end-of-grade achievement expectations. This was a very strong concern and the basis on which at least one teacher made her decision not to participate in the research study. Even though they were told that several books about Logo and various methods to teach it would be available to them and that they were free to use whatever material and methodology they wished, they expressed to me and to one of the principals that they wanted a written, outlined, step-by-step curriculum that they could follow. Because of the nature of this study and the nature of the Logo language itself, no such curriculum could be supplied.

The four teachers that are a part of this study shared some of these same concerns along with the teachers who participated in only the introductory steps. But some of their other concerns were unique.

(1) RAYLENE

The lack of knowledge of Logo and what it could do or lead to was of concern to Raylene. The shortage of time to implement Logo with her class was not a concern to Raylene but it did become a matter of concern for Raylene in the area of finding time to work through Logo material on the computer herself before she presented it to her students. This concern, in turn, was an integral and inseparable part of her concern regarding a lack of knowledge of the subject area in general. Because of the size of her class, Raylene felt a concern that was unknown to the other participating teachers. Before the study was started, there were only ten computers in the computer lab. Raylene questioned what she would physically do with 23 students and only ten computers. She felt that at least one more computer would have to be obtained in order that she could physically match numbers of students to computers in such manner as would allow both them and herself to function satisfactorily.

(2) CHRISTINE and

(3) CAROL

Christine and Carol did not share the time pressure concerns. They questioned whether their students would be able to cope with, and use the regular Logo language, because of their ability level. At a later date, during the implementation phase, I questioned both Christine and Carol as to the reasons why they did not share the time concerns expressed by the other teachers prior to the introduction of Logo to their students. At that time, Christine indicated that: "Although the TMH classes do have a curriculum, it

is a very flexible one in that there is not a set number of minutes for each subject. There is a greater degree of freedom in what and when we do things." Because of this, Christine indicated there is not the constant time pressure experienced by some other teachers.

(4) SUSAN

At the first meeting between the teachers, the principal and myself, at which time the concept of involvement in the research project was introduced, Susan expressed strong feeling that she would be unable to find the time to add an extra subject or curriculum area into an already full daily and weekly schedule. The demands on herself in terms of time and effort required to do a good job with her current curriculum were so heavy that she found it very difficult to see how she could add anything additional. Doing a 'good' job of teaching the subjects currently in the curriculum was important to Susan, not only from her own desire to do so but also from system and school expectations of high student performance on city and/or system-wide examinations. Susan felt that the time required by her to introduce and implement a new subject would diminish her ability to do a good job in the areas where city and/or system tests were administered to the students.

A lack of a working knowledge of Logo was also of concern to Susan. This echoed the concerns expressed by other teachers who felt that they either could not, or did not wish to, attempt to teach a subject about which they knew very little, or in which they felt incompetent. Although the usage of the computer hardware itself was

not of concern to Susan, the fact that she did not understand what Logo could do or what she could do with Logo was of concern.

While the concerns of Susan were similar to those experienced by the teachers who were introduced to, but did not participate in the study, she nevertheless did agree to participate in the research for whatever length of time that I, as a researcher, felt would be desirable and necessary. She decided that having the knowledge of another computer program that she would be able to use with various students involved in computer literacy would outweigh her concerns regarding lack of time and knowledge.

In summary, the three main concerns of the teachers, whether participating partially or fully in the study are:

- a) Lack of time to implement a new program or subject and a lack of time to adequately acquaint and familiarize themselves with the new subject.
- b) A lack of knowledge about the new program. What can it do? What can I do with it? What is the extent of its capabilities? How do I teach this to my students?
- c) Lack of a written curriculum with stated objectives, outlined procedures to follow, and end-of-course competency levels.

III. STRATEGIES AND METHODOLOGIES EMPLOYED BY TEACHERS DURING INTRODUCTORY PHASE OF LOGO IMPLEMENTATION

Although the four participating teachers did have concerns about interpreting and implementing Logo with their classes, each of them had personal reasons for wishing to participate in the study that overruled their concerns. The strategies and methodologies used by the teachers will be looked at under the headings of Introduction Phase and Implementation Phase, in order that any changes in methodologies and strategies will become evident, and if changes do indeed occur, it will be possible to explore the reasons they put forth for the changes they made. These changes in techniques and/or methodologies may in turn foreshadow ASPECT (B) of the research question: Do these pedagogical stances and classroom environments reflect any of the priorities expressed by Papert (1980) in his book Mindstorms?

(1) RAYLENE

One of Raylene's concerns had been the physical problem of putting 23 students at 10 computers. At the first session, only 21 students were present so the method Raylene used was to have two students at each of nine computers and three students at the last computer. One student was to do all the work and the other was to watch and not interfere.

To begin the session, Raylene introduced the various components of the hardware and they discussed very briefly what Logo was and she explained that it was a computer language that needed different words and instructions to make it work. Through the process of giving directions and questioning the students about results, or the lack thereof, Raylene introduced the students to the FD and LT commands. All of the students were to carry out each of her instructions before anyone in the class continued on. For example, Raylene asked the students to type in FD 50, LT 50 and to watch to see what happened. Many students had problems -- they forgot spaces, they held the keys down too long, or the watching students tried to help them locate keys and the working students tried to protect their right to the computer keyboard. Raylene circulated among the students and helped everyone to enter the two commands. When all had successfully accomplished this, she then went on to her next instruction. Verbal instructions were given and the students were expected to listen and then carry out the instructions on their keyboard. After instructions had been carried out, Raylene would question them as to what happened. Because of the high noise level created by students talking about what was happening, or in many cases, what was not happening on their monitors, Raylene had to continually remind them to be quiet so that they could hear her instructions. Several times during the first session, Raylene requested that they do only the commands she had given them, in order that the class could stay together.

After the introduction of and entering of, FD, LT, RT, and BK commands, Raylene told the students to change places with their partners so that the watching students could have a turn at working on the computer and the others could now watch. A similar pattern was followed with this group -- introduction of commands, entering by students, followed by questions as to what happened. After introducing the commands, Raylene also used a questioning technique to review these commands. For example, Raylene would tell them to clear their screens and then she would ask, "What do you need to do in order to clear your screen?" After a student answered correctly, the rest of the students would proceed to carry out the command.

The three students who were working at one computer encountered a problem implementing the above system in that one student didn't have a turn on the keyboard.

Although Raylene's class did not progress as far during the introductory period as she thought they might, she was still excited about what had taken place. She was concerned about the noise level, the amount of time it took for them to locate keys, and the incorrect commands the students entered when they held the keys down for too long a period of time. She felt that they were unable to achieve the results she wanted because of their inability to cope with the mechanical aspects of the computers. In spite of the problems presented by the students' mechanical inabilities resulting in the

class not being able to stay together and follow her instructions, Raylene felt the Logo class was a learning experience for them.

(2) CHRISTINE

Seated at a computer with students and teacher aides around her, Christine used the demonstration and explanation method to show what the turtle could do. She then questioned the students as to what they wanted the turtle to do and what they would have to tell it in order to get the turtle to do it. She questioned them as to what letter the command would start with and asked them if they could find the key with that letter on it.

Following several demonstrations of this nature to show the commands -- F, B, R, L -- the students were sent to the computers. Two students were at a computer with either Christine or an aide to help them. At the computers, the same methods and ~~strategies~~ were again used -- questioning the students as to what they wanted to do, what letter that command would begin with; asking the student to locate the correct key and when the key was pushed, to explain what happened on the screen. At the end of the session, the pictures that the students had created with various commands to the turtle, were saved on disc and printed out for them so that they had tangible evidence of what they had accomplished. Christine said she felt that the class had learned something and that she was satisfied with the way things had gone.

(3) CAROL

Methods and strategies used by Carol were almost identical to those employed by Christine. Carol also taught a TMH class, although her students were more numerous and younger than Christine's. At the end of the first class, Carol told me that she felt good about what had happened during the class and that learning had taken place. Although the students did have problems coping with the mechanics of the computers, this did not seem to concern Carol.

(4) SUSAN

Susan's six students had previously worked with computers, so during the introductory session she reviewed with them the mechanical aspects of the computer -- the keyboard, monitor, disc drive, printer -- and how to turn the computer on. She explained what she was going to do and what would be required of them. The students were given the basic commands, they were asked to enter them into the computer and to observe what happened. After being given a sequence of commands to enter and observe the results, the students were instructed to use these basic commands to draw a picture of their own. Susan walked around asking each student such questions as: "What did you want to draw? Do you have a picture in mind? Do you want to go Forward or Backward? What do you do in order to get it to go Forward?" The class concluded with a review of

the commands they had learned and the comment from Susan that "Next time, I will give you specific tasks using these commands you have learned. Today, you did whatever you wanted. Next time, I may have you draw a square or your initials."

Each teacher used methods and strategies which she felt best suited the students in her class. Each was consistent with her own teaching style and level of competence she felt with the new curriculum she was introducing. That this was so, was indicated by the teachers themselves in the discussions with the researcher which followed each of the first sessions. In spite of concerns which varied in type as well as in intensity, depending on the classes and individual teachers involved, the overall feeling was that the students were learning.

IV. METHODOLOGIES, TEACHING STRATEGIES AND CONCERNS OF TEACHERS IN THE IMPLEMENTATION PHASE OF THE LOGO PROGRAM

(1) RAYLENE

During the implementation phase, several different strategies were used in Raylene's grade two class. The strategy used in the actual physical placement of the students changed during the implementation phase. During the introductory phase and the early

implementation phase, Raylene had two students working at each computer -- one to work at entering commands on the keyboard, and the other to watch quietly. After several classes, she indicated her concern about the noise level with two students at each computer and the consequent fact that students could not hear her instructions. She was also concerned that the watching student was "interfering with the person at the keyboard." Because of this concern on her part, she decided that only one student would be allowed at each computer in subsequent classes and the rest of the class would bring materials to work on activities in another part of the room while awaiting their turn at the computers. In later discussions with Raylene, she indicated that she felt this method of physically arranging the students "worked better."

In both arrangements (two students per computer, and one student at a computer), Raylene stressed the necessity of the whole class or group staying together in the tasks she requested them to do. The methodology used throughout the implementation sessions was one in which Raylene would give specific directions as to what she wanted them to enter on the keyboard. For example, "Type in FD 50, RT 90, FD 50." Depending on whether the instructions would draw a figure that was new to the students, or whether it was a figure they had previously worked with, Raylene would either continue with specific instructions on how to complete the figure, or she would encourage the students to finish the figure on their own. By repeating her instructions and/or going around to the students

with individual help they might need in order to follow her instructions, Raylene kept the class or group working together.

The students had difficulty remembering the layout and placement of keys on the keyboard so Raylene decided she would draw a picture of the keyboard for them to practise on at their desks. Since I had such a printed layout sheet in one of my Apple II manuals, I obtained it for Raylene. She made enlarged copies for each of her students. Whenever there would be a few spare minutes, Raylene would call out a letter for the students to locate on their printed keyboards.

Reviewing through the use of questions was a technique used more extensively as the study progressed. Raylene would begin most classes with questions about Logo commands that the students had used previously, or about shapes such as squares or rectangles that the students had previously been working on drawing. Questions such as "Now we're going to make a rectangle. How would you make a rectangle?" or "What does the HOME command do?" or "How do you clear the screen?" were ones used to review material covered in previous lessons.

Repetition was used to reinforce commands and procedures used in drawing shapes. Many sessions were devoted to students drawing squares in different sizes and in different locations. Even after the rectangle was introduced, time was spent practicing drawing the square as well as the rectangle. Because the students had difficulty

remembering the precise instructions as to what they should enter on their keyboard, Raylene would repeat the instructions so that everyone could complete them.

Towards the end of the implementation phase, when the students were becoming more familiar with the Logo commands, the square, rectangle and triangle shapes, Raylene encouraged them to try to draw by themselves. She would ask them to "draw two squares on the screen" or "draw two squares and a rectangle." When working with the REPEAT command, Raylene encouraged the students to try different numbers in such commands as REPEAT 5 (square RT 45) to see what would happen on the monitor. Within the guidelines and parameters set up by Raylene, the students were encouraged to do various things on their own.

(2) CHRISTINE

After the initial two classes, the seven students from Christine's TMH class each worked at a separate computer. Christine and her two aides moved around the computer lab working with individual students. As Christine and her aides worked with the students, depending on what they were doing at the particular time, she would often repeat the following questions: "What do you want to do? What does that word start with? Can you find that letter on the keyboard? Do you like your picture? What do you want to add to it? Do you want to make a square? Do you want to make a big circle?

Are you finished? Do you want to save your picture? What do you want to call your picture? What do you want to do next?" Through this questioning technique, Christine helped the students take on responsibility for deciding what they wanted to do, to figure out how to do it, and what to do with it when they were finished. If the students did not answer a question, then a more specific question was asked. For example, if a student did not answer the question "What do you want to do?", then Christine or her aide would ask, "Do you want to draw a sun?" or "a square?", "a triangle?". If the student did not respond to the question "Can you find that letter on the keyboard?", then he/she might be asked, "Is the letter S on this line of keys?" If the question "What do you want to call your picture?" brought no response, the more specific question "Do you want to call your picture David?" was asked. This manner of questioning -- from general to specific -- was continued when necessary. For example, if a student did not answer the question "Is the letter S on this line of keys?", then a more specific question was attempted, "Is this the letter S?". This strategy allowed the students to respond at their functional level and yet forced them to remain actively involved with what was going on and the ownership of the activity remained with them.

Positive reinforcement was given by Christine and her aides in comments such as: "Good boy.", "That's really good." "That's really neat." "That's really nice." Another form of positive reinforcement was the printing out of the designs or pictures each student had created during the session with Instant Logo. This printed copy

gave the students a visual, physical evidence of their having achieved something.

Another strategy employed by Christine, was to make comments or ask questions which would encourage the students to try things on their own -- to do as much as possible without assistance. For example, "See what you can do on your own." or "You can make whatever you want." or "Now try doing it yourself." These comments encouraged the students to accomplish something independently.

Closely connected to this method of encouragement of independent work, was the encouragement of thinking about their picture. Positive statements and questions helped the students to think about what they were going to do and what they were doing. At the beginning of one class, Christine said to her students, "Why don't you think about what you want to draw before you do it, today. Plan it out in your head before you make it." Then she asked, "How can you use the shapes to draw something?" and "Could you use a square and a triangle to draw a house?" Christine also asked the aides if they would encourage the students to think about what they were doing -- try to combine two shapes. With one student, after he had drawn a circle on the screen, Christine asked the following: "What does that look like? What do you see every day that looks like that? Can you use this shape to draw a picture?" This questioning technique was used to encourage thinking on the part of the students.

Using alternative and additional methods to reinforce introduced concepts was shown by Christine when she devised a form of Bingo to give her students practice in locating the keys. This game also helped review with the students the results of using certain keys.

Christine indicated that she tried not to give too much help to the students so that the resulting pictures which they drew would be their own work and not hers. She wanted them to discover for themselves how things worked rather than make decisions for them on what their next steps should be. By allowing them discover how the keys worked and then doing work on their own, she felt that the final results, as well as the whole experience, would be more meaningful to them.

Christine's implementation methodology centered around the questioning of her students as to the directions and activities they wished to do and then letting them carry out the action themselves and when they achieved she would give positive reinforcement. Thus, her techniques in turn were part of the pedagogical strategy of forcing the student to claim responsibility for his/her work.

(3) CAROL

Implementation strategies very similar to Christine's were employed by Carol with her younger TMH students. Questions such

as, "What do you want to do now?" and "Are you ready to save your pictures?" echo the line of questioning used by Christine to encourage the students to think and to actively participate in their own projects with Logo. Positive reinforcement also played a large role in Carol's pedagogical strategies. In addition to positive verbal feedback, the students also had their printed copies of each day's — pictures as concrete evidence of their successes. These pictures were placed in each individual student scribbler in order that the students could visually identify their progress. By using very similar methods to those which Christine used, Carol encouraged her students to "do something yourself -- fill up your screen with more things."

(4) SUSAN

Throughout the implementation phase, the strategies used by Susan with her six grade three students were as follows:

- a) introduction of a concept
- b) encouragement to explore and discover what was inherent in the concept, and to mentally work out ways that the concept could be used.

Although the students were encouraged by Susan to try things on their own, they were not prohibited from discussing with fellow students what they were doing. At the end of the class, the students were asked to do some mental practice using the commands

as well as drawing various squares. They were encouraged to draw these squares out on paper and to form a plan, using their mental powers to figure out how they would go about it.

These methods and strategies were repeated in each class. After the first couple of classes, the students were soon working on their own different projects because they were learning and accomplishing things at different speeds. They were allowed to explore and try various methods of accomplishing the proposed task. Those who finished quickly were given other tasks or more challenging projects to work on. Student-directed exploration and discovery was not only encouraged, but urged. A student, attempting to draw his initials, asked, "How do I make a M?" Susan replied, "That's a hard one. You'll have to make the angle something different from 90. Try 45 and see what happens. That wasn't enough was it? Play around with other numbers and see if it turns the amount you want. Experiment with different numbers." Because of class time limitations, Susan gave assignments to the students to plan their work on paper and mentally figure out ways they might accomplish it for the next class.

Although techniques and strategies used by teachers varied—from the introductory phase to the implementation phase, the variations as indicated, were slight. Each teacher used strategies and methodologies that she felt would best accomplish the goals she

set for her classes. These goals were indicated and discussed in the informal interviews throughout the study.

(1) RAYLENE

Raylene wanted to familiarize her students with the use of computers -- how to turn a machine on and program it, etc. She also wanted them to have practice in following directions and working with a computer language.

(2) CHRISTINE and

(3) CAROL

Both Christine and Carol wanted their students to become familiar with the use of computers as they were aware of other computer programs which they wanted to use with the students at some later date. They also wanted the students to achieve as much as they could on their own and to be responsible for their own work. Thus Logo was used to encourage this. They also used Logo to reinforce language ideas they were working on in the classroom -- the sounds of the letters, the shape of the letters, the visual recognition of the letters, and recognition of the sounds of the letters at the beginning of words.

(4) SUSAN

Susan's goal was to familiarize herself with a computer program that she could choose to use at a later date with her computer literacy program. She also wanted to allow the students to explore

and see what they could accomplish in the time available to them.

To achieve these ends, the teachers employed the strategies and techniques as indicated.

CONCLUSIONS

ASPECT (A)

WHAT PEDAGOGICAL STANCES ARE INHERENT IN THE NATURE OF THE CLASSROOM CONTEXT THAT TEACHERS CONSTRUCT FOR LOGO?

The climate or context the teachers created for their Logo implementation is to a great extent the result of the influences discussed in the last section. It was because of these influences that the teachers made the interpretations and used the implementation strategies they did.

(1) RAYLENE

Within the context of her Logo classes, Raylene emerges as a disseminator of knowledge to those who do not possess it. Although Raylene felt herself to be on very shaky ground due to her lack of knowledge of computers and of Logo, she nevertheless took on the

role of a passer-on of knowledge. The students received the information as a group, carried out the instructions inherent in the information, and then waited for further information. Another aspect or side of this role is that of a controller. By keeping the group together in all their work and allowing them to do only that which they were instructed, it was assured that control over both students and situation was achieved. In the interview, Raylene indicated that she wanted the students to achieve things on their own; that she did things the students were leaning towards. It would appear from the data, that what happens at the philosophical or intent level is not necessarily what happens at the practical or working level. While indicating that she felt she was acting as a guide or catalyst, Raylene would seem, in actuality, to be more of a disseminator of knowledge and a controller of how the situation reacts to the information.

(2) CHRISTINE and

(3) CAROL

At first, both Christine's and Carol's approach seemed to be one of student-initiated exploration. There appears to be no overt concern for curriculum content nor achievement expectations. The students initiated the actions and carried them out. However, on closer inspection, another dimension emerged -- that of a highly structured framework within which Logo and the students were to fit. The structure seems to be one developed for dealing with TMH

students as a group or category. The patterns and strategies discussed previously are the framework for this structure. Whatever the curriculum content, it will be handled within and following this framework. Because the framework is consistent throughout the curriculums taught, cross-referencing from one curriculum content to another is easy. That such cross-referencing occurs in order to have one content support another is demonstrated in the data.

The teacher, acting somewhat in the role of programmer, takes the curriculum and the student, plugs them in at an appropriate place in the program or pattern and then works through the system or structure. This is not to say that the pattern or structure is not effective or efficient, or that individuality is not taken into consideration, but that the structure or pattern is the consistent focus. At one point, Christine mentioned that the students had more freedom in the Logo computer lab than they did in their classroom due to the sitting arrangements. In the lab, she was unable to be on top of things every moment to give the students immediate and constant feedback on their actions. By establishing such a structure for the students, it is possible the teachers felt that this would allow students to operate more independently when a teacher was not present.

(4) SUSAN

Susan's high level, consistent concern for curriculum and its time and content demands, gave the outward appearance of a very curriculum-bound teacher. Another item to support this view was her apparent interest in high student achievement on tests -- so much so, that at one point she indicated that she felt it was almost necessary to teach to the test.

In spite of the verbal picture Susan painted of herself as a teacher bound by curriculum constraints and demands, the stance she took in her Logo classroom contradicted this picture. Within the Logo classroom, because of her implementation strategies, she became a leader more than a teacher, a guide and a catalyst for the interactions of the students with Logo. As a result of no structural demands being imposed by the Logo curriculum, Susan fulfilled the role she saw herself as playing -- that of a teacher who encouraged student exploration, experimentation and use of their own imaginations. It would therefore appear that the curriculum-bound dimension of Susan's pedagogical stance is one superimposed by outside agents and adhered to only because of system expectations of student achievement. When such constraints were not in force, experimentation and exploration were the foundation of Susan's implementation strategies as she assumed the role of catalyst.

ASPECT (B)

DO THE PEDAGOGICAL STANCES AND CLASSROOM ENVIRONMENT REFLECT ANY OF THE PRIORITIES EXPRESSED BY PAPERT (1980) IN HIS BOOK MINDSTORMS?

Seymour Papert, with his colleagues, created Logo with specific purposes in mind. Based upon the ideas he formulated concerning "...children, the nature of thinking, and how children become thinkers" (1980 p. 208) while working with Jean Piaget, Papert set out to create a method or instrument that would aid children in their ability to learn, think and build their own intellectual structures. (Papert 1980 p. 32) He felt that such learning would take place spontaneously when people are in contact with the right materials. A child's intellectual growth must be rooted in his experiences. (Papert Logo Memo No. 2 1971 4-1, 5-1) Logo, he felt, would provide "children better ways and means to think about what they do; and this includes looking for activities whose structures might allow the child a particularly clear view of his own intellectual activity and so help him achieve a more articulate understanding of 'doing'. (Papert Logo Memo No. 1 1971 p. 4) According to its developers, Logo is a language for learning how to think -- a language with no threshold and no ceiling.

However, Papert and other educators had serious reservations about Logo being accepted and applied in an authentic form in the

present educational systems. Part of this concern is due to the underlying philosophy of the language itself. "Logo is child centered and at least on the surface unstructured and non-hierarchical. Most teachers at the present feel pressured to have formal, hierarchical and content-centered curricula." (Higginson 1982 p. 329)

Kelman (1983 p. 71) states this idea even more strongly. "Already, Logo curriculum guides come complete with behavioral objectives, Logo workbooks, and Logo multiple-choice test. Nothing could be more antithetical to the philosophy underlying Logo's development...the threat of Logo standardization...presents to educators a challenge of significant proportions, if the hopes and dreams of Logo's founders are to be realized."

Do the pedagogical stances and classroom environments of the four teachers in this study reflect any of the priorities or concerns expressed by Papert? To support Papert's and Logo's underlying philosophy, the Logo environment that is created must be child centered, with the child creating his own learning experiences, thinking about what he has done and using new thinking to create new experiences. In other words, he must build his own intellectual structures. By assuming the role of a guide and a catalyst, Susan's Logo environment was such that the child could discover and explore. Use of imagination, thinking about one's experiences and learning from them, were elements of this Logo context. This environment then, does reflect Papert's priorities. However, it also reflects Papert's concerns since in order to establish such an

environment, it was necessary to find a time and situation that would be outside the system. Susan felt that there was no, or very little, place for Logo inside the current system. That she was able to create an environment that reflected Papert's priorities was due to the fact that the time used for Logo was one which was given to her without content demands or explicit expectations. The students were also a group of children given to her without content or achievement expectations. Because she did not feel accountable to the system for what occurred in this time and with these students, the Logo environment was created outside the system.

The pedagogical stances taken and Logo environments created by the other three teachers reflect, to a large extent, Papert's concerns rather than his priorities. By assuming the stance of a 'passer-on-of-information' or a 'maintainer-of-the-system', the teachers could not to any great degree create a 'Papertian Logo' environment. Because content and the structure or pattern are the focus of these programs, they cannot be child centered in the way in which Papert envisioned them. To say that there was no 'building of one's own intellectual structures' would be inaccurate. However, the central focus was not on student exploration and discovery. Consequently the experiences that took place were not highly meaningful to those involved in the experience. Because the purpose behind the teachers' use of Logo with the students was not primarily to help them to learn to think, the resulting experiences could hardly reflect Papert's priorities. The concern that Logo would not be used in an authentic 'Papertian' way is borne out by these three

case studies. Papert felt that his ideas were revolutionary rather than reformist in nature and that the present school systems could not support the type of activities he envisioned. As a result of having teachers trained within the current educational system to perpetuate the style of teaching that is generally carried out today, there is indeed little room within the system for Papert's child centered, child directed, and child controlled model of learning.

ASPECT (C)

DOES A SPECIAL EDUCATION CONTEXT AFFECT THE LOGO IMPLEMENTATION IN ANY WAY?

Several factors influenced the creation of Logo environments within the Special Education classrooms. The first factor of significance is that the teachers did not feel the students were capable of using a regular version of the Logo language. Their students used a version called Instant Logo that allowed them to manipulate the turtle by means of one key commands. Only one student in the younger TMH class used a regular version of Logo. By using an instant version, the ability of the student to control the learning environment is limited because some of the decisions have already been made for him/her. Another aspect, mentioned under ASPECT (B), is the structure or pattern that has been established for working with Special Education students. While this pattern may be founded upon research into the most effective ways to teach

special education students, it again is a factor that limits the student's ability to control and direct his/her learning environment.

By the end of the three-month research period, the Special Education teachers felt that the students were getting bored with using Logo. They felt the students had learned something. More specifically they felt that they had learned how to operate a computer, in that what they did on the keyboard had a direct effect on what happened on the screen. They learned to go from the general idea of pushing keys to operate the computer, to pushing only specific keys to achieve specific results. However, the teachers did feel there was a ceiling to Logo. This was due to the fact that by the end of the project, they felt the students had reached it. The students had become bored doing the same things over and over again with Instant Logo and yet the teachers did not feel the children were capable of using regular Logo, where there would be no ceiling. Whether these limitations to Logo's scope are actual, or only imposed by the users, is questionable. It is possible that such limitations were a result of lack of knowledge on the teachers' part of the Logo philosophy and capabilities as well as their lack of experience in working with it.

Nevertheless, from the data obtained in this study, it would seem that for certain students there is a threshold and a ceiling to the Logo language. This may be a result of the school systems in which it is used rather than in the nature of the language itself, but further research needs to be carried out to answer such questions.

CHAPTER SIX

SUMMARY AND REFLECTIONS

Information is increasing at such a rate that in the very near future man will no longer be able to deal unassisted by technology, with this vast volume of knowledge. Not only will more advanced technology be required, but more importantly, those people who will successfully function in this "Information Age" will need different resources, orientations, and skills than presently being perpetuated within current educational systems.

The race is on world-wide to advance the technology necessary to create the 'intelligent computer' capable not only of speed and accuracy but also of reasoning and decision making based upon this reasoning. It is hoped that such machines as these will be capable of dealing with the information explosion.

Seymour Papert and other similar-minded people have concentrated their efforts in developing methods and techniques that will aid people in developing thinking and problem-solving strategies. One result of their efforts is the educational computer language known as Logo.

Put forth as a language that has 'no threshold and no ceiling,' it was hoped by its creators that Logo would help develop the user's

personal 'intellectual structures.' by encouraging the users to explore, experiment, (form hypotheses), prove or disprove them, and then to build on their past experiences to help solve new problems and create new experiences.

Although several major research projects have been carried out on the usage of the Logo language, none dealt at any length with 'ordinary' teachers and settings nor focused on how 'ordinary' teachers interpreted and implemented Logo with their students.

The purpose of this study was to investigate, using ethnographic methodology, how four teachers interpreted Logo and how these interpretations were implemented. These findings would in turn allow us to discover what underlying pedagogical stances were inherent in the nature of the classroom context that the teachers constructed for Logo. Having established this, one could then see if these stances and classroom environments reflected any of the priorities or concerns expressed by Seymour Papert.

By using two TMH classes in the research project, we would also be able to discover if a special educational context affected Logo implementation in any way.

Data was gathered through continual participant (researcher) observations, and discussions and interviews with teacher participants. This was done in order that a thorough description of

what actually occurred in the classroom from the teachers' perspective could be gained.

Several schools expressed interest in participating in the research but later withdrew due to lack of adequate hardware or teacher interest particularly when they found that there was no written curriculum for Logo. The teachers who did participate were able to see Logo as something they desired to implement within their classrooms. One participating teacher taught grade two, another worked with grade three students, and two others taught TMH students.

During this project, the researcher fulfilled the roles of being assistant to the teacher and also a researcher. As assistant to the teacher, the researcher conducted an introductory Logo session where the four teachers were introduced to Logo basic commands and time was provided for them to discover what these commands would do. No background information regarding the philosophy of Logo was provided except to indicate that Logo was developed as an educational computer language. During the rest of the project, a conscientious effort was made not to direct the teachers in any particular direction but rather to answer teachers' questions and enquiries in such a manner as to give information as requested but to leave any decisions as to strategies or implementation techniques to the teachers.

The second role of the researcher was one of a participant observer. Through the use of participant observation, field notes, teacher interviews, and informal discussions, a picture of the Logo implementation environment and strategies from the participants' point of view was developed.

At the conclusion of the study, an evaluation session involving the researcher, participating teachers, and the administration was held. At this session the teachers reviewed their feelings about their experiences with Logo implementation, their concerns and their plans for further Logo involvement.

From the data, which was written up in the form of four case studies, emerged several dominant areas which had bearing on, and directly or indirectly influenced how the teachers interpreted Logo and implemented it.

FINDINGS

The climate or context the teachers created for their Logo implementation is to a great extent the result of the influences just mentioned.

Within the context of her Logo classes, Raylene emerges as a disseminator or passer-on of knowledge. Another side of this role is

that of a controller. By insisting that the class stay together in all work done and follow precisely all computer inputs -- control over both students and the situation was achieved.

On the surface, the approach of Christine and Carol (both TMH teachers) seemed to be one of student-initiated exploration. However, on closer inspection, another dimension emerged -- that of a highly structured Special Education framework within which both students and their programs, including Logo, fit. The patterns and strategies used were the framework for this structure. Because the framework was consistent across the curriculums, cross-referencing from one curriculum content to another was easily and consistently done. By establishing such a structure for the students, it is possible that the teachers felt that the students would be better able to operate more independently when a teacher was not present.

Although discussions with Susan indicated that she was a very curriculum-bound teacher, her methods and techniques in the Logo classroom contradicted this conclusion. Here she became a leader more than a lecturer or controller, a guide and a catalyst for the interactions of the students with Logo. This role held true to the picture she saw of herself as being a teacher who wanted to encourage the use of imagination and exploration with her students. In her other classes the curriculum demands forced her to often desert this vision.

Both in, and subsequent to, his book Mindstorms, Seymour Papert expressed concerns about the adoption of Logo into schools in the manner in which he envisioned it. To support Papert's and Logo's underlying philosophy, the Logo environment created must be child-centered, with the child creating his own learning experiences, thinking about what he has done and using new thinking to create new experiences.

Did any of the pedagogical stances and classroom environments created by the four teachers reflect any of the priorities or concerns expressed by Papert? Susan's Logo environment was such that the child could discover and explore and direct his/her own learning, and thus it does reflect Papert's priorities. However, it also reflects Papert's concerns since in order to establish such an environment it was necessary to find a time and situation that would be outside the normal curriculum system.

The pedagogical stances taken, and the Logo environments created by the other three teachers reflect, to a large extent, Papert's concerns rather than his priorities. By assuming the stance of a 'passer-on-of-information' or a 'maintainer-of-the-system', the teachers could not, to any great degree, create a 'Papertian Logo' environment. Because the purpose behind the teachers' use of Logo with the students was not primarily to help them to learn to think, the resulting experiences would not reflect Papert's priorities to any great extent.

Logo is proposed to have 'no threshold and no ceiling' but the Special Education teachers felt that this was not true in the case of their students. The inability of their students to use the regular Logo seemed to indicate that there is a threshold. The teachers felt that an 'Instant' Logo was more suitable to their students' capabilities. Even with the Instant Logo, the teachers felt there was a ceiling beyond which their students could not progress. By the end of the three-month research period they felt the students had reached this ceiling. Whether these limitations to Logo's scope are actual, or only imposed by the users, is questionable. It is possible that such limitations were a result of lack of knowledge on the teachers' part of the Logo philosophy and capabilities, as well as their lack of experience in working with it. It may also be a result of the school systems in which it is used rather than in the nature of the language itself.

REFLECTIONS

Where then, does the information gained through this research leave us in regards to the original concerns raised in the Introduction? Children being educated in the schools today are moving rapidly into the information age. Man is forging ahead at an equally rapid rate to develop the technological equipment needed to deal with the vast quantities of information that man has discovered. The question that was raised is whether these children are going to have the resources -- physical, mental and emotional -- to deal with

this information and the advanced technology. Logo has been put forth as one way in which the children, or whoever uses it, can learn to think -- a resource which would seem to be most vital to a solid foundation.

This program is available currently and is being used in and out of school systems. However, the results of this research point to the fact that while Logo is being used, it is not often being used in a manner that will develop these crucial thinking and problem-solving skills. The purpose of this paper is not to place the blame on any individual or system, but to indicate the state of affairs for the people involved in this research project.

These results imply that even though computer programs may be developed that have the potential to enhance thinking and problem solving or that allow and encourage child-directed and child-controlled learning, unless they are implemented within an environment that is supportive, as well as by persons who will support such methods of learning, then the potential of the program and its participants as envisaged by Papert, will not be reached.

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APPENDIX A

Books Left With Principal at the School:

Bearden, Donna. The Turtle's Source Book

Bearden, Donna. 1, 2, 3 My Computer and Me

Kwok, Annie. The Workbook for Learning Logo.

Richardson, Pat. Logo

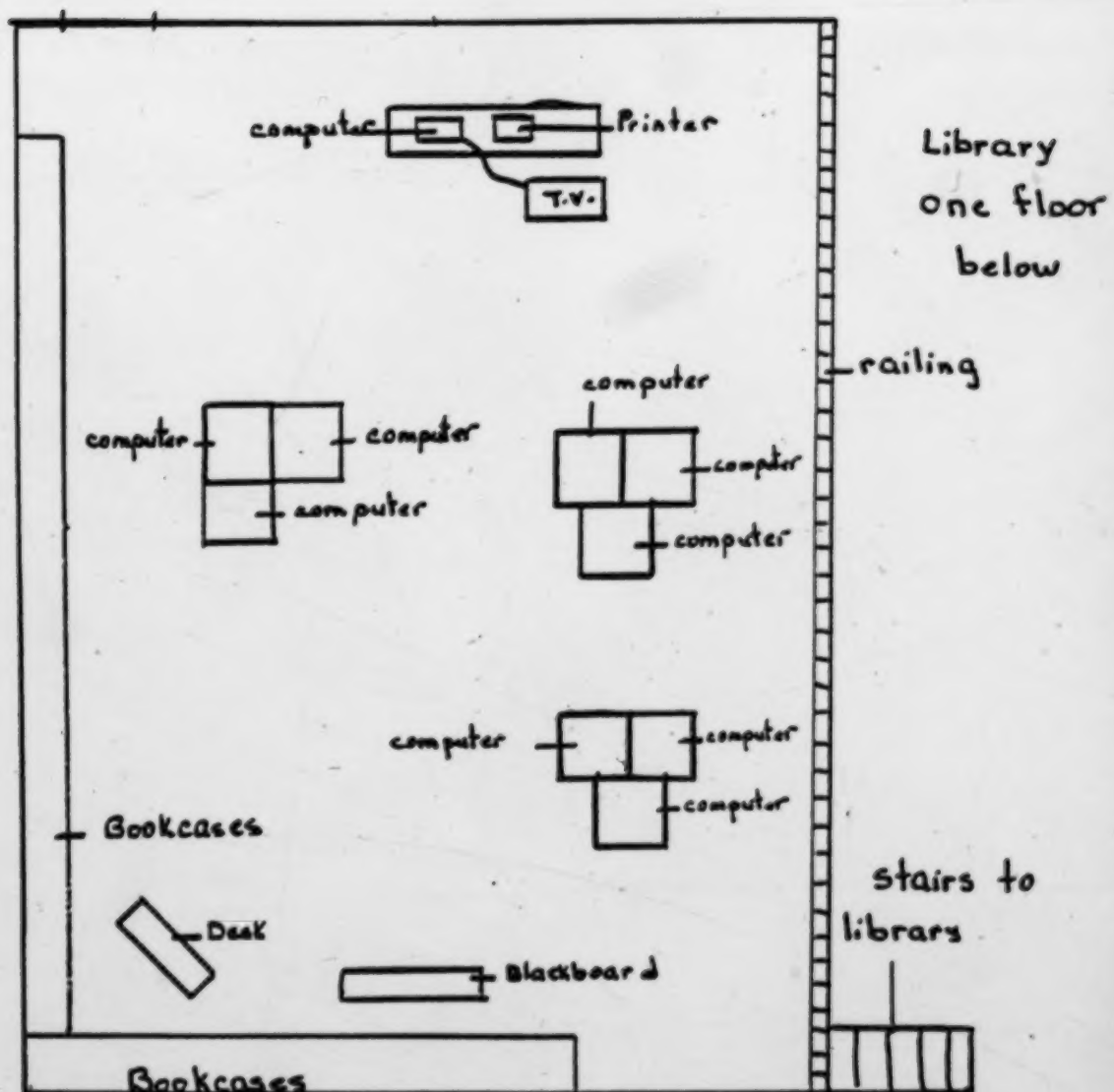
Torgeson, Shirley. Logo In the Classroom.

Thornburg, David. First Book of Robots and Computers.

Watt, Daniel. Learning with Logo.

APPENDIX B

Map of Computer Laboratory



APPENDIX C

Interview Questions Asked of Participating Teachers at End of Study:

1. In general, how do you feel about your experience with teaching Logo?
2. What do you feel the children gained from working with Logo? Is this what you thought they would gain or what you wanted them to gain?
3. What do you feel were the positive aspects of your experience with teaching Logo?
4. What do you feel were the negative aspects of your experience with teaching Logo?
5. What do you feel you got out of the experience of teaching Logo?
6. Would you have taught it differently if I would have not been present in the Labs -- in other words, did I influence the way you taught it?

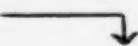
7. Would you teach it differently if you taught it again? How?
8. What conditions or things do you feel are desirable or necessary for you to have, in order for you to teach Logo the way you would want to?
9. Except for the fact that the children were working with computers, was the method or approach you used in teaching Logo similar to the approach you normally use in the classroom?
10. Were any activities related to teaching Logo done in the classroom? If so, what?
11. What, briefly is your background in teaching? Do you feel this background influenced either your willingness to teach Logo or the approach you used in the teaching?

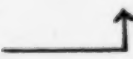
APPENDIX D

Complete Functions of Instant Logo Version:

F - Forward 

B - Backward 

R - Right 

L - Left 

T - Triangle



BT - Big Triangle



BBT - Big Big Triangle



C - Circle



BC - Big Circle



BBC - Big Big Circle



S - Square



BS - Big Square



BBS - Big Big Square



TR - House



SUN - Sun

